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PHYSICAL AGENTS IN THE TREATMENT OF BLADDER TUMORS*

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FOR one who has lived through the last twenty-five years and experienced the progressive changes in the treatment of bladder neoplasms, a review of this sort should be a pleasurable activity. Much, however, remains to be done before we can feel fully satisfied with our progress and our results. At the beginning of this century, the general attitude towards the radical cure of tumors of the bladder was pessimistic, if not hopeless. How different the present attitude! How many changes have been effected by the introduction of new physical agents and new technique in the handling of these serious conditions. Instead of advising "Hands off!" or drainage of urine by nephrostomies into the loin, we now go right ahead, at times perhaps treading ground which is better avoided, and yet often succeed where failure used to be the rule. In all new fields of therapy—and the cure of neoplasms of the bladder may be considered new, even though attempts of the kind have been made for many years—as new methods become available, one is liable to go too far and attempt too much, at times bringing adequate methods into disrepute. Moreover, owing to errors in judgment, one may expect of newer and untried methods more than they can accomplish, and in attempting the impossible, sad failures naturally take the place of the expected successes.

Owing to the newness of the subject, owing to the fact that we are all in a stage of experimenting, it is very difficult to make use of the cases operated upon in other clinics, as would be necessary if we were to give a broad cross-section of the methods and results in all the large clinics. It seems safer and wiser to present our own experience, based on the work of the head of the clinic and of his associates who follow rather closely in his footsteps, for the methods of attack which have slowly crystallized are pursued by all members of the staff. Naturally, we are all indebted to the work of other clinics, and suggestions, modifications, etc., are continually inducing us to make changes in details which probably would not be effected but for the constant interchange of viewpoints and ideas in meetings and through the medical press. In gathering these 418 cases for this analysis, I am indebted to my associates, Drs. Hyman, Ashner, Edelman and Mann. We have all followed much the same technique in treating bladder tumors, and the uniformity of approach to the problem gives perhaps some added weight to the conclusions.

* Read before the International Urological Congress at Brussels on August 4, 1927.

In considering the physical agents that we employ in the treatment of bladder tumors, I shall limit myself to the following:

1. The treatment of benign papillomata with the high frequency currents used through the cystoscope
   - A. Monopolar
   - B. Bipolar
2. The treatment of benign papillomata by non-cystoscopic methods
   - A. Paquelin cautery
   - B. Electric cautery
   - C. High frequency current
     - (1) Diathermy (bipolar)
     - (2) Radiotherm knife
   - D. Alcohol to prevent implants
3. The use of radium both through the cystoscope and through a suprapubic cystostomy
4. The use of deep roentgen-ray

1. THE TREATMENT OF BENIGN PAPILLOMATA WITH HIGH FREQUENCY CURRENTS USED THROUGH THE CYSTOSCOPE

In 1910 I called attention to the use of the high frequency currents in the treatment of growths of the bladder. I had used the monopolar current for the destruction of warts on the skin, and it seemed to me that with a properly insulated electrode it might be possible to use this current through a cystoscope and under water. While contemplating this problem, I was assured by an expert electrical manufacturer that such currents would burn out my cystoscope; but as soon as I tried a well-insulated copper electrode on skin warts under water through the cystoscope, I found that the instrument did not suffer and that the warts were destroyed. I derived my monopolar current from an old roentgen-ray machine, which I have used together with more modern ones up to the present day.

It is scarcely necessary to describe here a machine for the production of the Oudin (monopolar) and the D'Arsonval (bipolar) high frequency currents. It is, however, appropriate to call attention to the effects of these two currents so as to emphasize the differences that exist between them. In brief, the potential of the Oudin is high, while that of the D'Arsonval is much lower; in contrast, the amperage of the latter is higher than that of the former. It is of interest to study the effects of these currents both inside and outside the body. If one shapes a piece of raw beef so that there is a base, and attached to this by a pedicle a smaller mass of beef, one simulates the gross anatomy of a pedunculated vesical growth. With one flat electrode at the base and the other pointed electrode touching any spot on the surface with adequate current (D'Arsonval), one will find that there is destruction of tissue under the small electrode, and at a distance in the pedicle there is a concentration of the current which in a few moments coagulates this isthmus.

A. Monopolar. With the monopolar current, similar and more extensive local effects are produced under the electrode, but the distant effect in the isthmus is less active. Inside the bladder filled with water, with the monopolar current one sees this distant action in the blanching of large branches of the tumor more often than with the bipolar current, because the monopolar current attaches the growth to the electrode more readily and by doing so allows of raising the growth and making it, in part or in toto, more definitely pedunculated. The innumerable contacts with the bladder wall being broken, the current concentrates in the isthmus and coagulates its structures.

B. Bipolar. As the bipolar current fails to produce this firm attachment between itself and the fronds, one does not get this ideal distant effect as regularly. Still, everyone who has had considerable experience has undoubtedly seen this phenomenon even when using the bipolar current, as evidenced by finding on re-cystoscopy a massive necrosis which was not evident when the previous treatment had been concluded. On the other hand, in the open bladder one gets this effect regularly with the bipolar current, and one can demonstrate it as readily here as on the raw beef without even putting the electrode into the bladder. If the tumor is seized with a

blunt ring forceps and raised so that its fronds are fairly free from contact with the bladder wall, which is well retracted, one can shoot the current through this forceps by touching the latter with the electrode; the forceps are held in one hand the electrode in the other, and in a few seconds one sees the pedicle blanch, smoke, and in a moment it is burnt through completely.

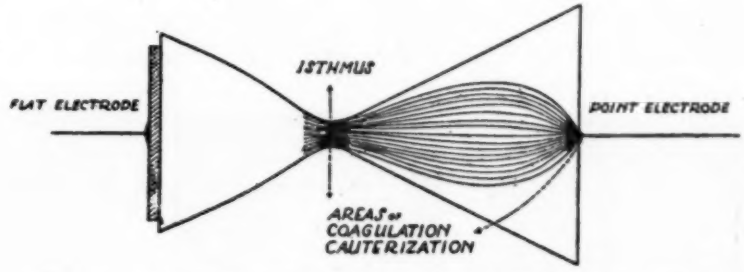

Fig. 1. Illustrating the distant effect of the bipolar current.

The bladder wall adjacent to the pedicle is moderately charred in this process.

These observations have led me for years to strive to have a grasping forceps electrode made for use through the cystoscope, so that at one or two sittings one could destroy a growth in toto by seizing it at any spot, raising it from the bladder wall, and then by shooting the current through, destroy its pedicle and vascular supply in a few moments. As yet, all the electrical technicians who have essayed to make such a seizing electric forceps with a flexible shaft have been unsuccessful. When this goal is reached, the bipolar current will have definitely gained the ascendency over the monopolar current in the treatment of benign papillomata that are accessible through the cystoscope.

Intravesically, the monopolar current, by virtue of its higher potential, has the effect of shooting away fragments of the growth, which effect is much less with the bipolar current. While the currents are playing, gas is generated, apparently hydrogen, as every once in a while, particularly if one is treating a neoplasm in the anterior wall, the gas is heard to explode. Outside the body, one can collect this gas over treated beef in a test tube, and by touching a match to it, get the typical explosion of hydrogen gas.

DANGERS

With the introduction of such powerful electric currents within the bladder, one might expect some serious accidents in the treatment of bladder tumors. Fortunately, such have rarely occurred. As the treatment requires no anesthesia, it is inconceivable that the viscus can be perforated, for the patient complains of pain as soon as the healthy bladder wall is touched. This is an excellent guide for the operator. Occasionally after the treatment, as the slough separates, a troublesome hemorrhage occurs which is, however, readily controlled by a second application of the current or by the use of an indwelling catheter in the severer bleedings. This, in my experience, has been a very unusual complication.

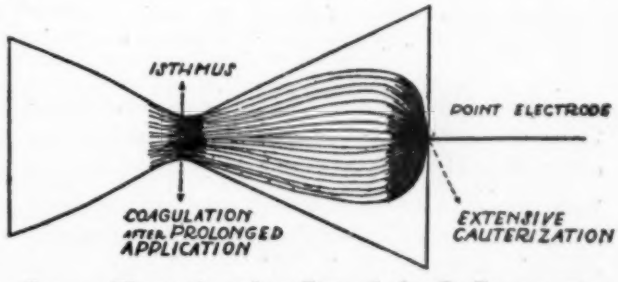

Fig. 2. Illustrating the effect of the Oudin current.

Perhaps the greatest danger lies in the fact that the treatment is so easily carried out that many unsuitable or malignant cases are treated in this way for months, when they should have been subjected to operation if they were to have any chance

of a permanent cure. Only the rarest case of malignant papillary carcinoma is cured by this treatment, and if one fails to get the typical response, the rapid melting away of the growth, one should abandon this method of treatment for the surgical approach.

As previously mentioned, one occasionally hears a mild detonation of the hydrogen gas within the bladder, but as far as my experience goes, this has never produced the result recently reported by Cassuto[1] and torn the mucosa of the bladder. Overtreatment of a benign growth produces an edematous solid-looking mass in the bladder wall which closely resembles an infiltrating carcinoma, and it requires great cystoscopic experience to recognize this peculiar reaction especially when it is very extensive.

Another rare accident is burning or shocking the patient by the electric current. With properly insulated cables, this should never happen, and with the electrodes now available one does not see this accident.

Fig. 3.

Fig. 4.

Fig. 5.

Sketch of bladder papilloma: first case treated after total necrosis of surface. Mrs. J. S., aged eighty-six. Attacks of hematuria since 1908. Treated with high frequency current in 1910. Twelve cystoscopies during the four years showed a normal bladder. Patient lived until 1919, when she developed a cardiac weakness and died. Figure 3 shows the papilloma. Figure 4 shows apparent necrosis following treatment. Figure 5 shows the small necrotic area still attached in front of right ureter meatus and small flat area behind right ureter meatus; the latter coagulated and was completely destroyed; the former was broken away with the electrode and coagulated.

TECHNIQUE

Having discussed the possible dangers and accidents, it is not out of place to say a few words about the method that we use. In employing the bipolar current, the flat-plate electrode is placed under the buttocks and flexible, well-insulated electrodes are used through the catheterizing cystoscope. If the monopolar current is used, we employ heavily insulated cable which is infinitely better than our older electrodes, as its insulation does not melt readily and it rarely has to be trimmed down during the seance. We are still somewhat partial to the monopolar current for the reasons set forth above, but there is no doubt that both currents effect the same results with almost equal satisfaction, though perhaps less quickly.

At the first session, with the unanesthetized bladder filled with water, the growth is thoroughly cauterized, the electrode being introduced into the fronds at numerous places and the current turned on with the foot switch. If the pedicle can be approached with the electrode, all the better, as a more massive necrosis will follow. If, however, this is not possible, one should try to get the electrode to adhere to one or more of the fronds at the first application of the current, and then by manipulating the Albarran finger, attempt to raise the growth on its pedicle as one turns on the current again. This maneuver may,

if successful, produce a massive coagulation in or about the vascular stem so that one is astounded at the next examination to see how extensively the growth has been destroyed.

At the first examination one can usually recover a specimen attached to the electrode or floating in the irrigating fluid (water) for microscopic study. If one fails to get a specimen in this way, one should use a rongeur or biting forceps to procure a specimen, as it is very frequently useful in deciding on the future treatment.

The endurance of the operator as well as that of the patient places a time limit on the length of each treatment, which usually lasts from ten to fifteen minutes. As it takes from one to two weeks for the dead tissue to separate, it is wise to wait a week or so before beginning the second seance. Small soft benign growths melt away so rapidly that they are completely destroyed in one treatment, and if the monopolar disruptive force has been used, the base is exposed and the wall of the bladder can be cauterized. This is less often seen with the bipolar current. Even in small growths one must wait for the sloughs to separate and cauterize the base at the second or some later sitting. At the second sitting one sees that a more or less complete destruction has been effected, and if the tumor has responded and is definitely smaller, and the microscope has confirmed the cystoscopic diagnosis of benign papilloma, one should proceed with this therapy. If at the second or subsequent seances one fails to see the definite destruction of the growth, and further microscopic studies show atypical cell growth, one should be on guard lest one is dealing with a malignant tumor. As Dr. F. S. Mandlebaum, our late pathologist, has said, wherever the usual orderly arrangement of cells and connective tissue stroma is seen with nothing atypical in either, the diagnosis of a benign papilloma must be made. If, however, the relationship between cells and stroma is disturbed or lost, if the cells are atypical in size and shape, and show variations in staining reactions, with or without proliferation into the stroma, a tentative diagnosis of carcinoma should be made, and this diagnosis can usually be corroborated after complete removal of the growth.

After the growth has been destroyed, the small soft scar left in the bladder mucosa is often hard to locate. The heavy scars that Heitz-Boyer* speaks of are not seen in properly treated cases, though one does see them in over-treated cases, whether the monopolar or bipolar current is employed.

DIAGNOSIS

SUITABLE AND UNSUITABLE CASES

There is no doubt that the well-trained cystoscopist can usually interpret the picture and differentiate between a definitely benign and a definitely solid malignant growth. But in between these two

* Heitz-Boyer's numerous publications have somewhat obscured a very simple method. I am glad to see in his recent paper before the 111. Congress of Italian Urologists that he has announced that he now destroys the growth with electrocoagulation and then applies the monopolar current to the base so as to get soft smooth scars, which we are all accustomed to see.

As far as Heitz-Boyer's contributions to this subject are concerned, I have again reviewed all his publications and fail to comprehend why he makes this simple procedure so unnecessarily mysterious and difficult to understand. In America some of us spoke of the high frequency treatment as "sparking," translated into French as étincelage, long before he ever took up the method in[2] 1911. It was my object to introduce a really simple and effective method which could be used by the ordinary cystoscopist through the ordinary cystoscope. The modification that Heitz-Boyer suggests requires a totally new cystoscope, new and special electrodes, and differs, as his French colleagues (Legueu, Papin and others) have observed, in none of the essentials from the original method. He claims he gets no thermic action from his very high tension current, but in another passage he speaks of the growths as being "escarifié"[1] by the current. Perhaps his current has a higher tension than that employed by others, but that the sparks are cold can be easily disproved by applying the electrode to one's own skin and holding it from 1 to 2 mm. away, as Heitz-Boyer tries to do in the bladder. In his 1913 paper in the *Journal d'Urologie* he speaks of sparking "à distance" (!), though he advocates pushing the growth out of the way with the electrode so as to cut through the pedicle. From all this it would appear to me that the so-called modification is, in all essentials, the technique originally described in 1910; and judging from the paper referred to at the beginning of this footnote, Heitz-Boyer has gradually come round to this viewpoint himself.

extremes, there are all sorts of pitfalls, and I believe we all make mistakes in interpretation, some of which may be fatal to our patients. This decision is absolutely essential, as one is not justified in using the high frequency currents except in benign papillomata, as I have always insisted. When inflammation is present in the bladder, it may be most difficult to interpret the picture. In addition to the rather typical picture presented by a benign papilloma, our two greatest aids are found in the study of the response of the growth to the treatment and the microscopic study of specimens removed from the growth. Rapid and satisfactory melting away of the growth usually means a benign process, although occasionally one sees this in papillary carcinomata. Absence of response almost invariably means malignancy. Microscopic study of specimens will also prove helpful if one has an experienced pathologist at hand. Whether the classification of Broders,[3] based on the cell differentiation which allows him to subdivide all these growths into four groups varying from those of mild malignancy to the very malignant, will be generally accepted is open to some doubt. These diagnoses are often based on small fragments of the tumor and it is notorious that in serial sections of bladder growths one at times obtains most varied pictures in different parts of the growth.

While it is generally granted that a papilloma with delicate waving fronds, grey-pink in color, attached to the normal bladder wall by a narrow pedicle, is almost invariably a benign tumor and will respond to the high frequency current, nevertheless from time to time one sees such a delicate papilloma apparently responding but sprouting always anew between treatments; and eventually at operation one finds one has been absolutely mistaken and the apparently benign growth is only a papillary excrescence in the mucosa overlying a diffusely infiltrating carcinoma. Sessile papillary growths with thick fronds or with fronds that have grown together, giving a more solid appearance, are often benign and can be readily destroyed with the high frequency current. On the other hand, similar growths in which some of the fronds are necrotic are very suggestive of papillary carcinomata, and the microscope will often decide the question so that the failure of the high frequency treatment to accomplish a cure will lead the surgeon to the proper surgical procedure. Occasionally some of these cases may respond to the current more rapidly if exposed to radium (applicator or seeds,) but how fre-

Fig. 6.

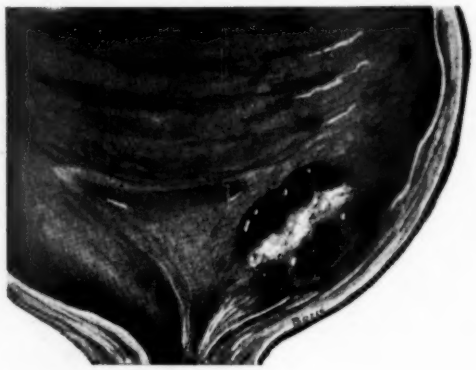

Fig. 7.

Bladder papilloma. Mrs. E. C., aged seventy-one. Attacks of hematuria for fifteen years. Treated with high frequency current in 1910. Figure 6 shows an edematous, rather solid-looking papillary growth. This was rapidly destroyed and apparently overtreated, as seen in the peculiar reaction shown in Figure 7, where the base resembled a malignant thickening of the bladder wall. Linear cauterization of this area showed it was firm and sensitive. Shortly after this treatment this reaction in the bladder wall disappeared, and thirteen control cystoscopies during six years showed a normal bladder.

quently this happens, how much is the result of the high frequency current and how much is the result of the radiation is difficult to evaluate. Young has been most enthusiastic for this combination, and further work may convince all of us of the correctness of his views. When the tumor is partly papillary and partly solid, or when the adjacent bladder wall is thickened and edematous in the cystoscopic picture, as well as by rectal or vaginal touch,* the diagnosis of malignancy is almost certain; but even here it is worth while having microscopic control so that the attack can be planned with absolute certainty.

Having excluded as unsuitable all the above cases that do not conform to the benign group, we still have a considerable number of definitely benign papillomata which cannot be readily treated transurethrally with the current. I have found that tumors surrounding the sphincter, as well as tumors near the sphincter that bleed profusely so that one cannot work intelligently, are very difficult to cure definitively and are better off if operated upon. Cases of extensive papillomatosis, also, either primary or secondary to a previous operation, are often very difficult and tedious to cure, both for the patient and surgeon. In addition, one does encounter patients who are so intolerant, for one reason or another, that one cannot get a fair chance to use the method under discussion. All these groups, together with the malignant cases, should have a more radical attack and their growths should be destroyed through the open bladder, using the bipolar current as a cautery, resection if possible, radium seed implantation if non-resectable, or at times total cystectomy.

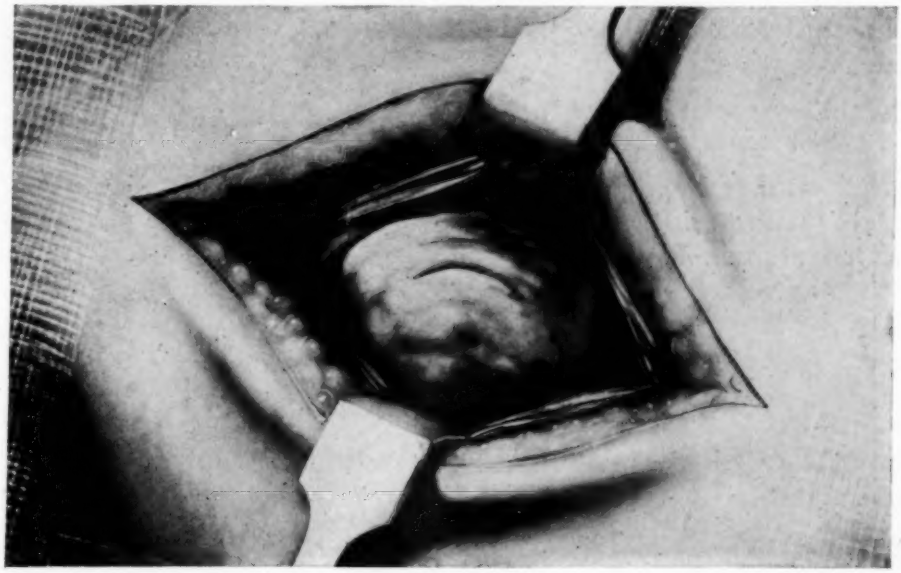

Fig. 8. Wide extraperitoneal suprapubic exposure of bladder in moderate Trendelenburg position after irrigation and emptying of organ.

RESULTS

After a bladder tumor has been destroyed by the use of the high frequency currents, duty to the patient is by no means finished. All cases should be regularly controlled by cystoscopic examinations, at first in three months, then in six months, and finally each year for several years; for one of the strange peculiarities of bladder papillomata is their tendency to recur in a new site in the bladder, with a tumor springing up de novo perhaps years after the original growths have been destroyed. Moreover, it

* Cystograms may also be of use in showing the deformation of the bladder wall as well as the size of the growths.

is no rarity to see the character of these new tumors varying greatly in degree of malignancy from the original growth. Incompletely destroyed tumors recur in situ, but the type of recurrence just referred to, probably the result of the irritation that led to the first tumor, is in every sense a new tumor rather than a recurrence in the usual sense. Most recurrences or "recidives," are the result of growth of cells that have been overlooked and not destroyed, whereas both the benign and malignant "new" tumors just referred to have nothing to do with the original growth, except in so far as they are apparently the result of the same causation. If patients are not regularly controlled they are exposed to these serious dangers and, strange to say, no matter how often one emphasizes the importance of this control, patients, even physicians who are patients, refuse to submit to this wise precautionary measure. As the result of this attitude, though we have treated many hundreds of tumors of the benign type in a large number of patients with the high frequency currents through the cystoscope, we cannot give a fair statistical statement of the end-results. While we have patients that were controlled for fifteen years by cystoscopy and have remained perfectly well, the largest number of cases have withdrawn from cystoscopic observation after one or two cystoscopies which showed a normal bladder.* To class such cases as cured is stretching a point, for everyone who has had much experience in this field has seen such normal bladders present years afterward either a benign papilloma or a carcinoma at the same or in a different site. The original growth may have been destroyed but the bladder condition was not controlled if new tumors developed within the viscus.

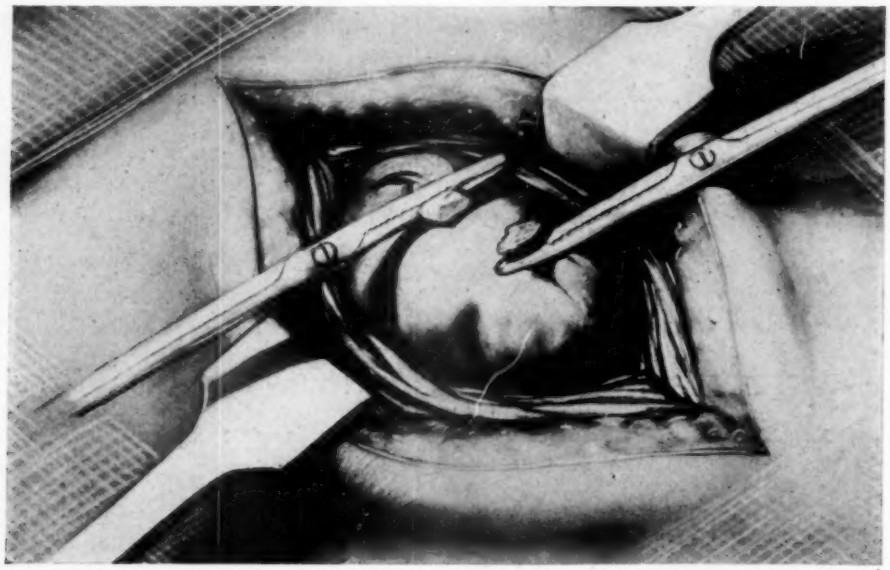

Fig. 9. Liberation of bladder from its bed. Division of the urachus. Bladder pulled out of abdomen.

This attitude of the patient, this peculiarity of the bladder in producing new tumors must be borne in mind in considering a statistical study. Statistics may tell the truth, but in view of the attitude of patients we cannot furnish anything approaching an ideal tabulation. We do know precisely, however, that we can definitely destroy the original benign growths with these currents and that, with adequate cooperation, the benign recurrences in new sites can be equally well controlled.

In all we have records of 158 patients

* No matter how careful one is, a tiny bud of tissue may be overlooked and later a tumor of some size may be found at the old site.

treated with the high frequency currents through the cystoscope, representing over 200 tumors. When the treatment was new, we used considerable persuasion to make the patients submit to re-cystoscopies so that we could determine fairly definitely what this therapy offered; but as time went on, this effort could not be sustained and multiple controls became less frequent. It is of interest in this connection to note that

Table 1

SUMMARY OF 158 CASES OF BENIGN PAPILLOMATA TREATED THROUGH THE CYSTOSCOPE

89 cases controlled by cystoscopy and apparently cured.

23 recurrences.

Papillomata treated with the high frequency current, well as controlled by cystoscopy:

Year.....	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
No. of cases.	41	16	10	7	3	6	1	1	1	2	..	..	..	..	1

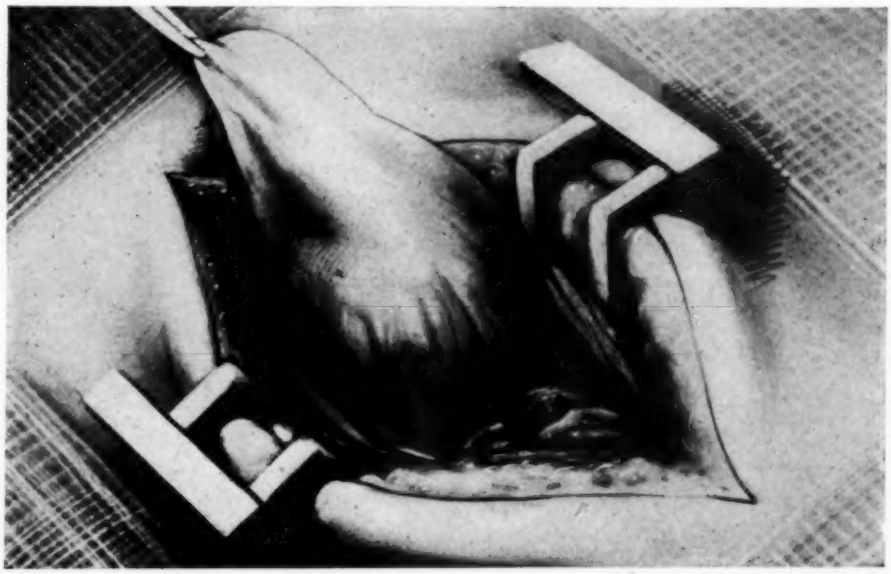

Fig. 10.

Figures 10 to 17 illustrate the method or technique used in the treatment of bladder tumors by open operation.

the first 4 cases treated by this method had 7 to 13 control cystoscopies after their original tumors had been destroyed, and some were controlled in this way fifteen years after destruction of the papilloma without showing any recurrence. The fact that a patient is alive and symptom-free years after destruction of a growth, of course, is no evidence that the bladder is free, as I have seen some very large tumors (primary) that gave none of the classical symptoms of papilloma of the bladder. In the above series, numerous patients belong in this category but are disregarded in our analysis. Of 158 cases, 89 have been reexamined in the first year up to the fifteenth year, as shown on the table, and found free from local recurrence or new tumors. Twenty-three more have been re-cystoscoped and have had local recurrences, or more often recurrences in a new site either papillomatous (8) or carcinomatous (15). Some have shown new benign tumors as late as the ninth year after destruction of the original growth as controlled by repeated cystoscopies, and some have shown carcinomata as late as the seventh year after destruction of the benign growth. This accounts for only 112 cases out of a total of 158 cases. Of the 46 uncontrolled cases, some are apparently well according to letters received, others have been lost sight of, and some of these have, undoubtedly, developed recurrences benign or malignant, whereas others have died of intercurrent maladies, coronary disease, pneumonia, etc., without having any further bladder symptoms.

From the above analysis it would seem that under the present conditions we must expect about 20 per cent recurrences of growths either in the old or in new sites in the badder if the disease once gets a footing in this organ. Naturally, if incompletely treated, the recurrences in the original site will be regularly found and will be much more frequent than those in new sites. Experience, I believe, has shown very clearly that this latter type of recurrence in situ can be avoided by adequate treatment but, as yet, we have no way to control the other type of recurrence in a new part of the bladder, except by using the utmost vigilance and persuading patients to submit to regular re-cystoscopies.

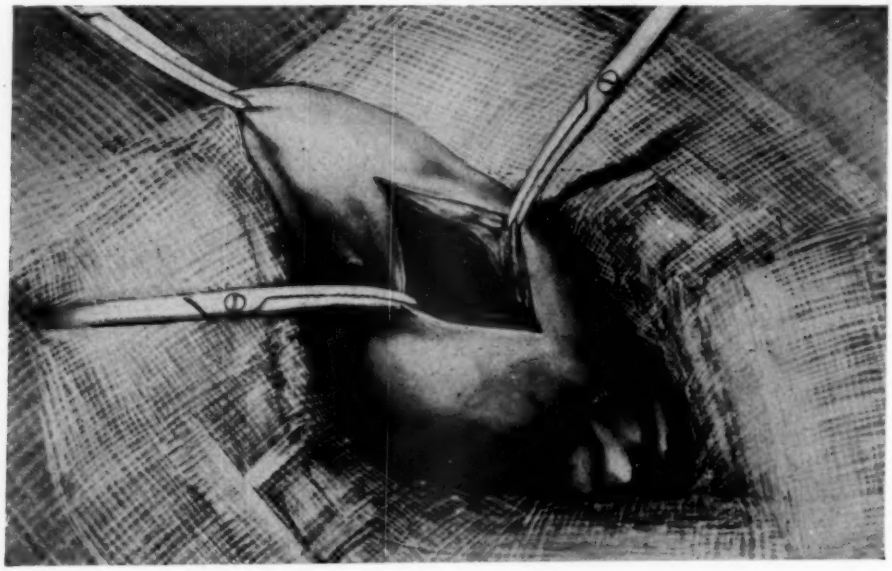

Fig. 11.

2. The Treatment of Benign Papillomata by Non-Cystoscopic Methods

Realizing that all benign papillomata are not amenable to the transcystoscopic or transurethral method of approach, it became necessary to develop a method of treatment for this type of case. Most papillomatoses, especially those so frequently resulting from a previous operation that has spread the disease far and wide on the bladder mucosa, growths about the sphincter that bleed or that cannot be readily reached and destroyed, and growths in intolerant patients, usually demand more radical operative procedures. In 33 cases we have had to resort to the operative treatment, using the technique to be described shortly.

Paquelin Cautery, Electric Cautery and High Frequency Current. During these suprapubic exposures of the neoplasm, the physical agent used to destroy the growths was heat as generated by the Paquelin cautery; but improvements led to the substitution of the electric cautery, and this again gave way to the use of the high frequency currents through the open bladder. With the bipolar current used in this way, we have a most efficient method of destroying these growths, coagulating the small growths in situ by touching the ball electrode to them, or, if larger and pedunculated, by seizing them with a blunt ring clamp and touching the electrode to the clamp as the growth is raised from the bladder wall on its pedicle. Here the distant action of the bipolar current becomes very evident, large pieces if not all of the growth rapidly come away, allowing the base to be thoroughly coagulated with this current. If the growths are very numerous, use may be made of the so-

called radio-knife or needle to cut them off electrically through their pedicles. This employs a new modality of high frequency current with over one million oscillations. This current concentrating at a needle point, very much like the de Forest needle with which I experimented in 1908, cuts through tissue with the ease of a scalpel and usually closes the small vessels. With a hooked or curved needle one can rapidly cut through the papillomatous pedicle by raising the growths and slipping the needle against the pedicle. Then the exposed pedicle can be coagulated with the ball electrode by throwing the coagulating current into the electrode.

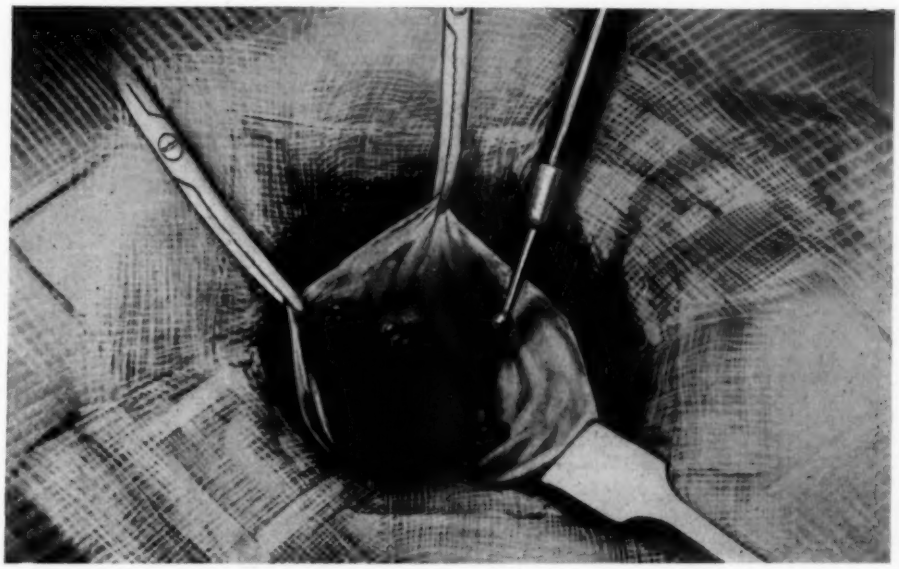

Fig. 12.

Alcohol to Prevent Implants. After the bladder has been completely cleared of all evidences of growth, it has seemed to me that, knowing the tendency of these tumor cells to implant themselves on raw surfaces and to produce recurrences, our duty is not finished. To prevent these potential implants, I have for years soaked the bladder and the whole wound with strong alcohol for five minutes before sewing up, and I have the very distinct impression that this is effective, together with the other measures used, in physically destroying any loose cells that might be floating free and might grow into tumors. I have seen patients suffering from recurrent papillomata after repeated suprapubic operations submit to the above type of operation for general papillomatosis of the bladder and become completely cured and well, controlled by cystoscopy for years after the last operation.

Judging from the controlled cases, it would seem that the chance of cure in these operated causes is somewhat better than in the cystoscopic series, 15 per cent recurrences in those controlled; but there is a primary mortality of 12 per cent plus attached to this procedure, which is surely higher than in the cystoscopic treatment.*

Table II

Summary of 33 cases with benign papilloma or papillomatosis treated by open operation. Suprapubic cystotomy with high frequency cauterization, with or without the radio-knife

Mortality: 12 per cent

Recurrences: 15 per cent

Apparently well: 17 cases, or 60 per cent of operative survivors:

Year.....	−1	1	2	3	4	5	6	7	8	9	10
No. of cases	3	1	6	..	1	2	1	..	3	..	..

Apparently well, controlled by cystoscopy, 11 cases.

* Our records show 1 fatality in the cystoscopic method caused by a bacteremia following cystoscopy.

Of 29 cases surviving operation, 20 were followed and 17 were apparently cured, or 60 per cent.* It is difficult to see why these cases should not suffer from new benign or malignant tumors just as often as the first series. More extensive experience will probably clear up this point, as more cases submit to regular cystoscopic control.

As I consider all steps in this operative procedure of fundamental importance, aimed as they are against implanting tumor cells in the bladder or in the parietal wound, the following description and illustrations are presented.

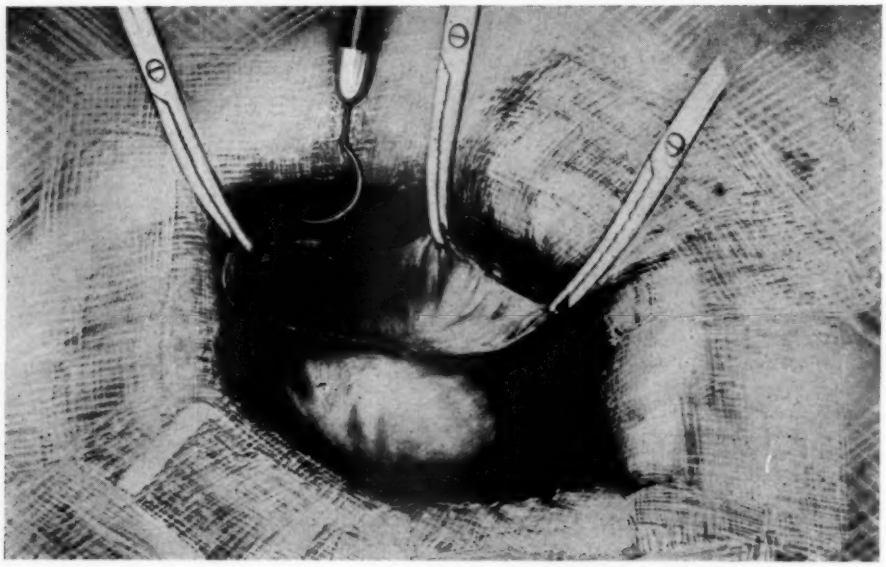

Fig. 13.

TECHNIQUE

The more carefully one studies the results of surgery of bladder neoplasms, the more evident it becomes that successful treatment depends upon the avoidance of tumor cell implants; for recurrences, except in the infiltrating malignancies, where they may be due to incomplete operations, are usually due to such implants. The successful treatment of papillary tumors, benign or malignant, is, strange to say, a better test of treatment than that of infiltrating carcinomata, as in the latter it is always difficult to determine whether one has removed all the cancerous depots in the bladder wall or not, while in papillary tumors such difficulties are much less frequent, for the obvious reason that one can see the growth in its entirety. The cure of cases of papillomatosis speaks well for a surgical procedure and is an excellent test of such a procedure, while frequent recurrences speak against such a procedure. Even under older methods, when less attention was given to the implant aspect of the problem, occasional operative cures were scored. Under the present technique, results are ever so much better.

I have favored the extraperitoneal approach[4] since 1912, and Squier, Voelker, Latzko, as well as others, use the same approach in cases demanding bladder wall excision. Briefly, the technique follows:

1. The bladder is gently irrigated and then emptied so that when it is opened the wound is not flooded with fluid containing tumor cells.

2. The patient is placed in a moderate Trendelenburg position and a wide vertical suprapubic incision is made.

3. As the bladder is exposed extraperitoneally, it is freed from its bed of fat and peritoneum by blunt dissection to either side of the urachus, which is double

* Eighty-five per cent of followed cases.

clamped and cut between. The clamp on the bladder end of the urachus is used to draw the bladder forward and towards the symphysis as the peritoneum is sponged off its posterior surface. This may be opened accidentally and will allow palpation of the extent of infiltration, etc., of the walls of the bladder.

4. After the bladder has been well freed down to or beyond the trigone in this manner, the perivesical space is carefully packed off with several layers of gauze abdominal pads, which protect the perivesical space and the incision in the parietes.

5. Then, depending upon the position of the growth or growths, the bladder is incised either through its anterior, its posterior or its lateral walls. The incision should be gradually enlarged so that wipes or suction can sponge up the little fluid that may be in the viscus. Sponging within the bladder should be reduced to a minimum. As the incision is enlarged the papillary growth will become evident, and it is immediately cauterized in situ with the bipolar current, as previously described or with the electric cautery (hook) or with the Paquelin (hooked point). In cases of multiple growths each growth is separately burnt, and every suspicious spot is treated similarly. A too-extensive cauterization is preferable to one too-superficial.

6. Having a rather deep cavity to expose, it is wise to use retractors of different sizes and lengths, rather than automatic retractors,* so that all surfaces of the organ can be gone over readily, and none are covered except momentarily by the blades of the retractors. Again, to hold the organ well out of the body, clamps without teeth are applied to the bladder incision as it is being made. The use of clamps with teeth such as the Kocher, which produce minute perforations in the bladder wall, thus possibly producing implants, should be avoided.

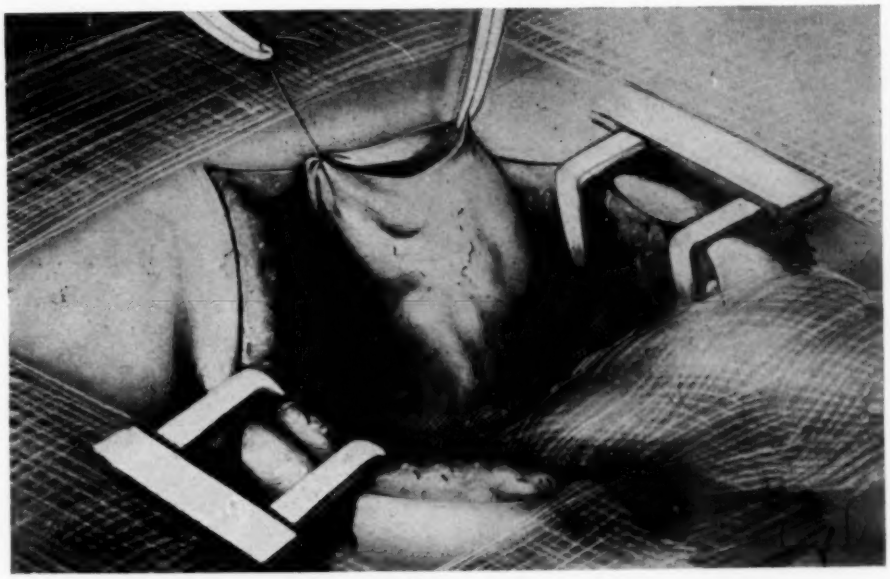

Fig. 14.

7. Being satisfied that all the visible tumor or tumors have been destroyed, our next efforts are directed against possible cell implants. These may be in the bladder incision, loose in the bladder or on the gauze protective packings about the organ. The incision which opened the bladder may be lightly seared with the electrode, proceeding from clamp to clamp in orderly fashion, each clamp being removed in turn as the cauterization proceeds. Then the table is lowered, and the whole wound is filled for about five minutes with alcohol,

* An automatic retractor in the parietal wound is essential and helpful.

the bladder being allowed to slip back into its bed so that its cavity as well as the protective gauze is exposed to the effects of the alcohol which it is hoped will coagulate any potential cell implants that have broken away during the various manipulations.

8. After this thorough bath in alcohol, the gauze protective packings are removed and fresh gauze is substituted. The bladder is sponged dry and its incision closed, after making provision for suprapubic tube drainage. In closing the bladder, a layer of plain catgut sutures is used to infold the charred edges of the incision, and over this a layer of chromic gut is applied to support the first layer.

9. The incision in the parietes is closed in layers, and drainage with rubber dam or gauze to the bladder, both above and below the tube which enters that organ, completes the procedure.

From a consideration of the above points, I believe it will be agreed that everything that can be done to minimize the danger of implants has been utilized and it must be evident that such a thorough technique could only be carried out through an extraperitoneal approach.

After the pedicle of these apparently benign tumors has been coagulated, it may be difficult to decide whether there is an infiltrated base. If there is doubt, it is well to place some radium seeds in the suspicious area, running them obliquely to the lumen of the bladder lest one produce an extravesical infection by introducing the seed too deeply into the mobilized bladder wall.

In malignant tumors of the bladder, papillary carcinomata and solid infiltrating carcinomata, wherever possible we resect after mobilizing the bladder; in the former, usually a less wide resection is required than in the latter; in some cases part of the bladder wall is destroyed and radium seeds placed in the base. In tumors of the posterior wall which are liable to extend to the serosa, it is advisable to enter the peritoneal cavity before opening the bladder: then as the bladder is mobilized, the involved serosa can be left attached to the growth and the opening in the peritoneal cavity can be closed prior to incising the bladder wall. Here again we coagulate with diathermy the whole surface of the growth with one pole in the bladder, and with the radio-knife we make a rapid resection. If a ureter is involved it is reimplanted, after the flooding with alcohol, by the simplest technique drawn into and attached to the

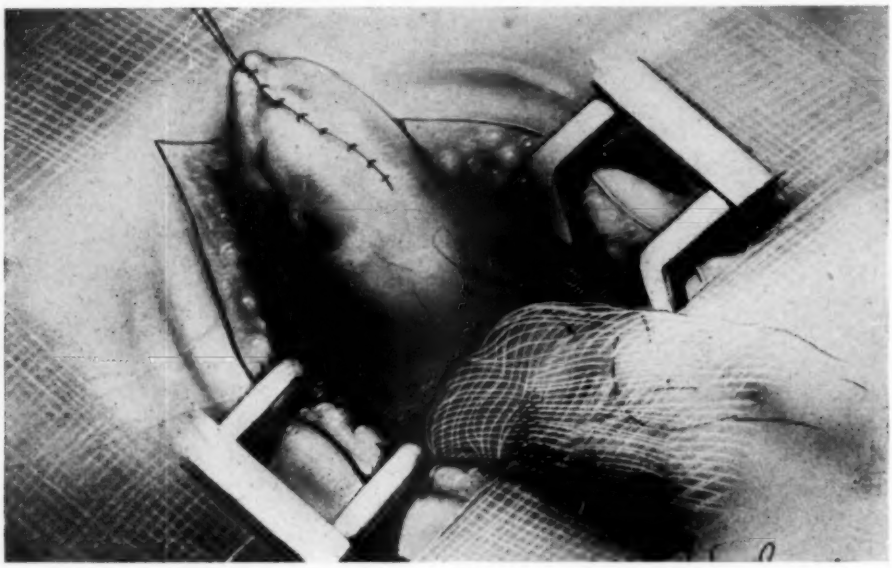

Fig. 15.

inside of the bladder without any tension and also fastened to the outer wall of the bladder with a couple of chromic gut sutures. By using the radiotherm and diathermy in this way, we often do an extensive resection without tying a single blood vessel. If a vessel must be clamped, its lumen is readily closed by touching the diathermy current electrode to artery forceps. This coagulates the tissue at the bite

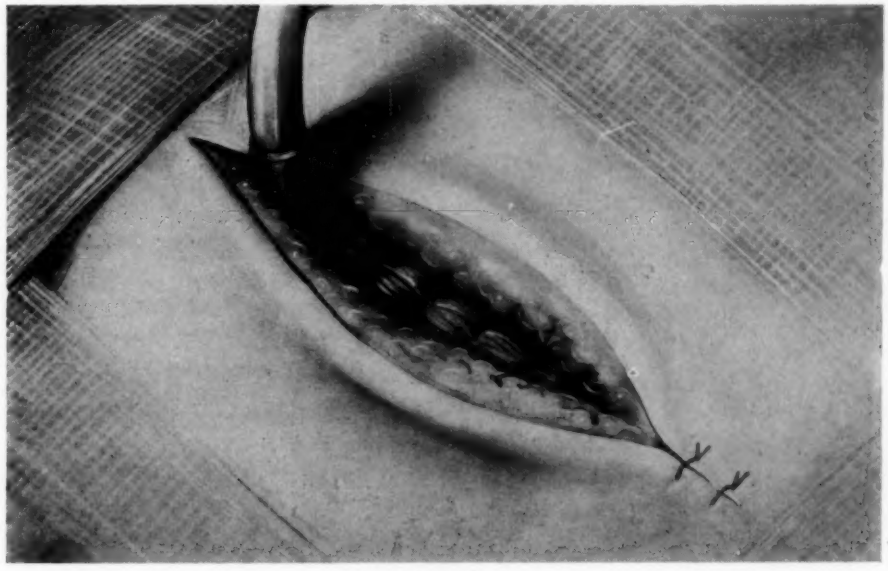

Fig. 16.

and the forceps may be removed without any bleeding.

Unfortunately, a great many cases present themselves so far gone in their malady that this more or less ideal resection cannot be done. If one takes only the simpler cases, the operative mortality will be correspondingly low, but if a good result has been obtained after a most extensive resection, one is liable to feel encouraged to attempt a repetition, or even attempt more hopeless cases. This frame of mind is quite natural in developing a field in which the therapy has not been stabilized. Previous to 1912, I find records of 5 cases of infiltrating carcinomata done transperitoneally, of whom 2 died in the hospital, 2 developed local recurrences, and 1 was cured, but died of apoplexy six and a half years after the operation. In this case, cystoscopic controls were negative, the last being four years after the operation.

Since 1912 there have been 28 cases of papillary carcinoma, in 15 of which part of the wall, though not the whole thickness, was resected and cauterized, with actual cautery originally and later diathermy, and in 13 cases the whole thickness of the bladder wall was resected. In 3 cases radium seeds were introduced into the coagulated base. The mortality in this series was 14 per cent. Of those that survived, 15 are alive and apparently well, or 60 per cent of the 24 who survived operation. Four could not be traced; 6 had recurrences (25 per cent), and of these, 1 was re-operated and is well one and one-half years after second operation.

Table III

Summary of 28 cases of papillary carcinoma as treated by open operation

Operative mortality: 14 per cent

Recurrences: 25 per cent

Apparently well: 15 cases, or 60 per cent of those surviving operation, as controlled by cystoscopy:

Year.....	−1	1	2	3	4	5	6	7	8	9	10
No. of cases	2	2	2	3	1	2	1	1	..	1	..

From this small series one cannot decide whether the whole thickness of the bladder

wall should be removed. Some of the oldest cases had only a partial removal of the bladder wall. All in all, there is no striking difference between the end-results that can be attributed to the amount of bladder wall removed, which is probably due to the fact that there was no extensive infiltration at the pedicle. From the few cases in which radium was used, no deductions can be made, though 1 case has gone three years since the operation.

The mortality in the 18 cases with ureter transplantation (2 simple ligations) was the same as when the ureter was not involved. Of this group, 1 patient was alive and well almost ten years, 1 six years, 1 five years, 1 three years, 1 a year and a half. The five- and three-year well cases were controlled by cystoscopy. The end-results to date would be, 5 patients well out of 14, or 35 per cent, which is better by a little than the whole group of resected infiltrating solid carcinomata. This may be due to the fact that the excision, naturally, was more extensive.

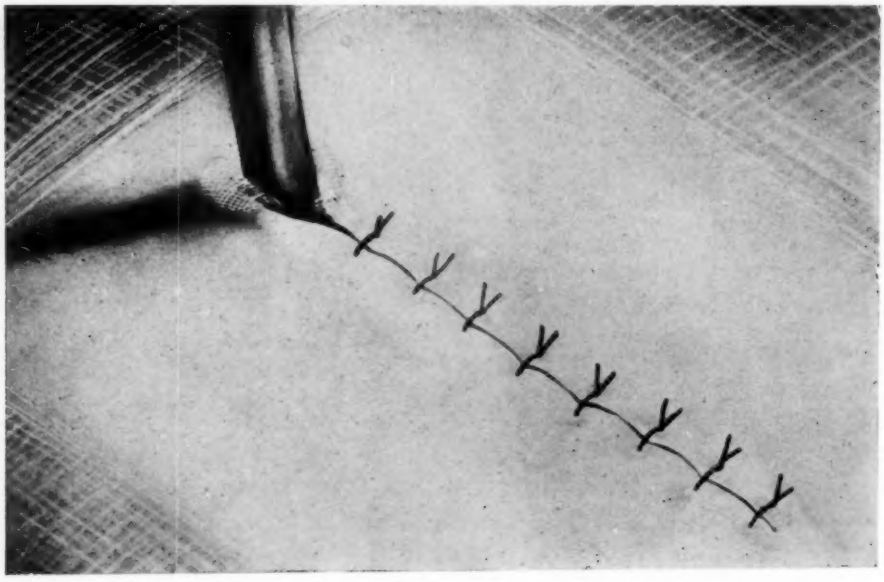

Fig. 17.

The most difficult cases to treat are the definitely infiltrating carcinomata, of which we resected 37 cases, with re-implantation of the ureter in 17 cases. Eight cases died in the hospital (21 per cent); 16 cases are fairly definitely known to have developed recurrences; and 13 cases are alive, 6 of them controlled by cystoscopy and with no recurrence.

Table IV

Table of 37 cases of infiltrating carcinoma treated by resection with or without ureter transplantation

Operative mortality: 21 per cent

Recurrences: 43 per cent

Apparently well: 13 cases, or 35 per cent of those surviving the operation

Year.....	−1	1	2	3	4	5	6	7	8	9	10
No. of cases	2	2	1	2	1	2	1	1	..	..	1

Apparently well, controlled by cystoscopy, 6 cases.

It is of interest to note that in this group 4 cases had preoperative deep roentgen ray about three weeks prior to operation, with the object, usually, of shutting off the vascular and perhaps the lymphatic channels, to avoid dissemination by the operative trauma as well as to devitalize the carcinoma cells (though histological studies did not confirm this). The fibrous tissue about the bladder, resulting usually from such roentgen-ray exposure, renders the operation of extraperitonealization more difficult, but in view of the fact that all 4 cases failed to develop recurrence, this should receive further consideration and study.

In this group as well as in the preceding

group, the physical agents, the high frequency current in the form of electrocoagulation, or diathermy with the radioknife, has surely introduced a change for the better, even though we are not justified in considering the above 28 cases as definitely cured. In these cases the biological variations of the tumors are such that even after five years following a total cystectomy, I have found at autopsy carcinoma tissue in the iliac glands and along one ureter. These patients also object to re-cystoscopy which, moreover, in a deformed resected bladder may be inconclusive. The best we can do is to determine whether they are alive and apparently well, realizing that there is always a danger of recurrence which will bring our statistics of satisfactory end-results to lower figures.

3. THE USE OF RADIUM THROUGH THE CYSTOSCOPE AND THROUGH A SUPRAPUBIC CYSTOSTOMY

One of the most recent physical agents to be used effectively in bladder neoplasia is radium. In 1911, with an inadequate supply, I tried this without success and shortly thereafter, reading Paschkis' unfavorable report, I abandoned my efforts for years, though originally I felt that it might prove as useful as the high frequency currents used through the cystoscope, if not more useful.

Under the great stimulus of B. Barringer, this field was again explored, and we treated 16 cases with radium emanations introduced through the cystoscope. There were two types of cases in which it was employed: first, in patients with multiple tumors which varied in their appearance from soft typical benign to almost solid growths. In these, specimens from the former tumors were microscopically benign, and from the latter carcinoma was reported. Into these solid growths 1 to 4 seeds of 2½ mc.* were introduced, and then at the next sitting the necrotic growths were further annihilated with the high frequency currents. In these cases we had excellent results. In the second group, we imbedded seeds because, owing either to the position of the growth near the sphincter or to the general condition of the patient which made operation seem inadvisable, our results have been most unsatisfactory. This is probably due to the fact that it is impossible to place the radium regularly where it will destroy the whole tumor, the procedure even in the open bladder being somewhat of a "hit-or-miss" affair. In all we have used radium through the cystoscope in 16 cases. In 8 cases we have had excellent results and the tumors have been destroyed; these belong in the first group. In the second type, I cannot find a single cure or disappearance of the growths.

Radium seeds (rarely surface applications as well) were used through the open bladder in definitely infiltrating carcinomata, where the growth could be definitely felt with one finger outside and the other within the viscus and the infiltration established, in 31 cases. It has been claimed by some that the mortality in this procedure is so low that it should be the routine method of attack in all malignant growths. In our experience, the highest mortality was seen; 11 cases died, or 33 per cent. It must be admitted that most of the cases were very extensive, often involving the sphincter area, and anything short of a total cystectomy with prostatectomy would have been quite impossible to effect a radical excision. Wherever we could resect, we did so. If we had permission for total cystectomy (5 cases), we did this operation. In the absence of these two conditions, we have always had radium present in the operating-room so that we would not be compelled to do a simple drainage operation or a more or less superficial electrocoagulation. Of these 31 cases, 1 treated with B. Barringer was cured of a solid growth close to the sphincter as controlled by 10 cystoscopies over five years. At the eleventh cystoscopy, a benign papilloma was detected in a new site on the posterior

* Originally glass seeds of ⅓ to ½ mc. were used, but of late, platinum seeds of 2½ mc.

wall and destroyed with the high frequency current. One is alive after three and three-quarter years and developed a papillary carcinoma in the posterior urethra. One was well and lived three and a quarter years; one two and a third years; and 2 others lived two years also without recurrence. In at least 2 cases we saw no result. Three cases were not controlled, and 7 died or are suffering from their disease; 2 cases are too recent to be of any value.

From these figures it is seen that of the 20 cases that survived the operative procedure, 6 were cured of their original neoplasms, or 30 per cent. When we consider the type of case included in this group, it is evident that radium emanations used as seeds have surely improved the outlook for these otherwise hopeless cases. Before radium was available we all saw countless cases in whom we never got further than a simple cystostomy, if they consented to that much. In my personal records I have 52 such cases prior to the radium era. In addition to these, numerous cases of recurrences following operation elsewhere, or absolutely hopeless and untreatable cases are found in our records. This tragic picture we expected to see changed with the introduction of the roentgen-ray therapy.

4. THE USE OF DEEP ROENTGEN RAY

When the deep roentgen-ray was heralded, we all turned to it with expectancy, hoping it would be an aid in this field. We used it in the primary inoperable carcinomata and the recurrent inoperable carcinomata with an almost uniform negative result. L. T. Mann has recently reviewed 17 cases of papillary carcinomata and infiltrating carcinomata of the bladder, and in only 3 cases had there been any relief of dysuria and hematuria. There were no cures and life apparently was not prolonged. As these cases were treated by various experts, the uniformity of the bad results is all the more striking. It is difficult in view of our experiences to give much credence to some of the recent reports on the efficiency of the deep roentgen-ray treatment in these conditions. Whether deep roentgen-ray treatment prior to cystoscopic high frequency treatment will prove of any value, in the sense that some claim, of an adjuvant action between radium and the high frequency current, I do not know, but some observations have suggested that this relation may exist.

In this brief report, I have attempted to survey our experience with the various physical agents used with and without cutting operations. I regret that I cannot give a better picture of the situation and a more glowing series of end results. I have purposely condensed the material as much as possible.

TABLE V

SUMMARY OF RADIUM CASES TREATED CYSTOSCOPICALLY AND THROUGH SUPRAPUBIC INCISION. RADIUM SEEDS USED IN 47 CASES

GROUP A: 16 cases. Radium seeds introduced through cystoscope:
No mortality
8 apparently cured
8 recurrence or no effect

GROUP B: 31 cases. Radium seeds introduced through suprapubic cystostomy:
Mortality: 33 per cent
6 cases controlled and apparently well out of the 20 that survived operation, or 30 per cent

SUMMARY

During recent years there has been a great change in the outlook of patients suffering from bladder neoplasm, owing to the introduction of physical agents. Though much has been accomplished, especially in benign growths there is still considerable work to be done in the malignant growths, especially in the infiltrating non-resectable carcinomata. Our experiences in over 400 cases are detailed in the printed report, and here I shall attempt to give a brief résumé.

Amongst the physical agents employed are:

1. Various modalities of the high frequency currents through the cystoscope.
2. The use of these currents through the opened bladder combined with alcohol to prevent implantations.

3. Resections of the bladder with the radio-knife actuated by a very rapidly oscillating (1,200,000) high frequency current.

4. The use of radium seeds (emanations)
   (a) through the cystoscope
   (b) through the open bladder

5. The use of deep roentgen ray

1. The trans-cystoscopic use of the high frequency currents has given excellent results. Both the original growths and any possible recurrence are readily destroyed. There are well-recognized differences in the effect of both the so-called monopolar and bipolar currents, the former being more explosive and of higher tension, while the latter is of higher amperage. The distant action of the bipolar is of great use in producing a massive coagulation in the pedicle, as can be demonstrated on a piece of raw beef properly shaped so as to simulate a pedunculated growth, or when the bladder is open and the papilloma is seized and raised with a blunt forceps and the bipolar current is allowed to run down this forceps into the growth. It produces an extensive coagulation at the pedicle and adjacent bladder wall. The monopolar current has a similar distant effect but much less marked. The ideal treatment through the cystoscope would be by means of a forceps electrode, which could be as readily applied as the above forceps through the open bladder.

Only benign growths should be treated with these currents, and if in doubt as to the cystoscopic accuracy of diagnosis, a biopsy, occasionally a cystogram, will aid in establishing the nature of the growth. Lack of adequate response to the current speaks against its benign nature. There are benign cases which do not lend themselves to cystoscopic treatment, e.g., extensive papillomatoses, tumors at the neck, or in inaccessible situations, tumors that bleed profusely at every examination, etc., and these are treated better by open operation.

The trans-cystoscopic treatment has given us in over 158 cases excellent results. In about 20 per cent we see recurrences in a new situs or in loco, the latter due to incomplete destruction and the former to possibly overlooked growths or to new growths resulting from the original causative agent.

2. In the operative treatment everything must be done to avoid implants. Good exposure by extraperitonealizing the bladder in the Trendelenberg position, careful packing-off of the wound, and operating on the empty bladder assist us in reaching our goal. The bladder is opened with the radio-knife and as the growths present, they are coagulated with the current and removed with the cutting needle (curved). We used to use the Paquelin, later the electrocautery, but for two years we have been using the radio-knife. We have had 33 cases in which this procedure was necessary, and our apparent end-results with this technique are excellent though there is a primary and considerable mortality. Eighty-five per cent of the survivors are apparently cured. We say apparently, for it is difficult to tell when a case is to be classed as cured, having seen, five years after a total cystectomy and apparent health, carcinoma in the iliac glands. Cystoscopic control is essential and it is notorious how difficult it is to persuade patients to submit to regular reexaminations. We are convinced that flooding the wound with strong alcohol, which coagulates potential implants (free tumor cells), has been of greatest value.

3. In carcinoma cases, the papillary and the infiltrating, we use practically the same technique as under (2) coagulating the growth and then resecting. We always have radium present so that in case the growth cannot be resected, we can try to destroy it with this physical agent. Of this group we have had 65 cases (28 plus 37) with apparent good results in 60 per cent of the papillary carcinomata and 35 per cent of the infiltrating carcinomata.

4. Radium emanations we have employed in 16 cases trans-cystoscopically,

with apparent successes in 50 per cent; whereas radium applied through the open bladder in non-resectable growths, usually at or near the sphincter, has given us our highest mortality (33 per cent), and only 6 cases (30 per cent) of the total of 31 cases seemed to be cured.

5. In 17 cases of carcinoma, we tried the deep roentgen ray without any curative effect, though occasionally there was some amelioration of the symptoms.

From this summary, it is evident that the picture has changed materially, and instead of advising "Hands off!" in these growths, we are now getting results that we can be proud of, even though we are far from the goal at which we are aiming.

REFERENCES

1. Cassuto, A. Explosion dans la vessie au cours d'une électro-coagulation. *J. d'Urol.*, 1926, xx, 263.
2. Heitz-Boyer. Assoc. française d'Urol., Session 15, July, 1911, v, 790, 781.
3. Broders, A. C. Epithelioma of the genito-urinary organs. *Ann. Surg.*, Phila., 1922, lxxv, 574.
4. The illustrations of the extraperitoneal approach are from Beer, E. Technic of operative treatment of neoplasms of the urinary bladder. *Ann. Surg.*, 1921, lxxiii, 75.

THE TREATMENT OF GENITAL TUBERCULOSIS*

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AT the Congress in Brussels there was a discussion on genital tuberculosis, and some items brought out were not uninteresting.

The first paper was by Dr. J. Dellinger Barney, of Boston; the second by Drs. Carlo Gamberini and Pietro Marogna, of Italy; and the third by Dr. Kenneth M. Walker, a British surgeon. Neither Dr. Barney nor Dr. Walker ventured into any very extraordinary researches, but put forth sound doctrine, Dr. Barney repeating the general impression that tuberculosis begins in the epididymis, rather than in the prostate or in the genitals, and Dr. Walker not even committing himself on that point. They advised epididymectomy, etc.

Drs. Gamberini and Marogna were more interesting, because they favored a type of treatment which we are not familiar with here. The treatment goes by the name of "Durante." The method is the multiple injection into the tuberculous nodule of small amounts of an iodide solution, if the nodule has not yet broken down. If the nodule is cheesy, it is incised and curetted, and 10 per cent iodoform and glycerin injected. As healing progresses, the injection is repeated on the third to the seventh days. Thus resorting to epididymectomy is avoided. They spoke as if the prevailing custom in Italy were this injection system.

This was extremely interesting to me, because I have been faced a good many times, as anybody who does consultation work is, with the problem of a patient who has had one testicle removed with a guarantee that this would cure his genital tuberculosis. Even if a cure does result on this side, he often develops a tuberculosis of the opposite side. And when tuberculosis appears on the second side, he is so frightened he does not come to a physician until the disease has become very extensive. Then he comes, full of anxiety lest he lose the second testicle. We hesitate to attempt epididymectomy, because the whole mass is so indurated that it seems impossible to enucleate without interfering with the blood supply of the testicle.

In the last few years it has been my practice in such cases simply to curette out the foci, incising the tunica vaginalis, delivering the testicle in the usual way and splitting the epididymis end-to-end, curetting out all the tuberculous foci and suturing the skin with catgut to the edges of the gutter. The result is a very slow healing. The focus remains open. At the end of the eighth or ninth month it is fairly well healed, the induration has contracted upon itself, and there remains at the upper or lower end of the epididymis a small tuberculous nodule with a fistula leading to the skin. When the rest of the healing is complete, and the testicle seemingly normal in shape and size, it is simple to excise the nodule and do a real cleaning up of the scrotal tuberculosis, leaving the patient what looks like a beautiful testicle.

This is really doing the same thing as the Italians do in a more complicated way by iodine injections—a cleaning up of the focus without actually attempting to excise it. I do not see the virtue of the iodine treatment when epididymectomy can be done. In all advanced conditions I would advise this operation, which gives satisfactory results.

Dr. Marion spoke in the discussion at the Conference and excepting one other, who spoke on differential diagnosis and

* Read before the meeting of the American Urological Association, New York Branch, October 26, 1927.

insisted upon the difficulty of distinguishing tuberculous from non-tuberculous cases where there had been a gonorrheal epididymitis, Dr. Marion's remarks were the most interesting. He stated that many years ago he had begun doing an epididymectomy on the normal testicle as a matter of routine at the time he excised the diseased epididymis, in order to prevent recurrence of the good side. I have had a good deal of interest in that for a number of years, because many of these patients are sterile at the time they first come to the doctor for a tuberculous epididymitis. Specimens of the semen have showed sterility, in which case vasotomy was done on the opposite side. On such patients I have not happened to see a tuberculous epididymis of the second testicle. Yet I have had this curious experience: In 3 cases which came for epididymectomy there were spermatozoa in the semen, and I therefore did not do a vasotomy on the opposite side; and within eighteen months two had tuberculosis of the opposite epididymis.

Therefore I wonder if Dr. Marion is not quite right in saying it is wise to remove the second epididymis at the time the first is found tuberculous. My discouraging experience seems to point to taking radical steps and removing the second epididymis, which will surely protect the second testicle.

DISCUSSION

Dr. J. Sturdivant Read. I was struck with Dr. Keyes' contribution about curetting tuberculous abscesses in the epididymis. We have all seen cases where these abscesses have broken spontaneously, and the cases were really cured for a long time. I found the gist of the treatment he suggested very useful.

Dr. Paul Aschner. I tried resection once, and gave it up. In this instance I did an epididymectomy on the diseased side and ligated on the other side, and two weeks later the patient had a tuberculosis of the other epididymis. Infections travel through the blood stream, and not by way of the vas deferens.

Dr. Edwin Beer. In the course of Dr. Marion's presentation, he called attention to the fact that he used to tie off and cut off a piece of the vas, and was surprised to find a tuberculosis developing at the stump, and he had therefore resorted to the policy Dr. Keyes has referred to.

At the last meeting, Legueu presented studies of pyeloscopy and ureteroscopy. By pyeloscopy and ureteroscopy he means direct fluoroscopic inspection of the pelvis and ureters as they are filled and as they empty. He gave a very dramatic presentation of his observations, calling attention to the peristalsis in the pelvis and its resemblance to the duodenal bulb, and also emphasizing the striking pictures produced by the peristaltic waves in the ureter. He referred to one of our colleagues who had spoken to him concerning 300 cases of ureteral stricture observed during the last two months in his practice. Professor Legueu stated that he had seen such pictures which might be interpreted incorrectly, and that peristaltic waves often simulated strictures. In his experience in these studies, stricture of the ureter "N' existe pas."

Dr. Edward Keyes. Replying to Dr. Aschner: I have curetted 5 cases, and so far have had no complications. I agree, however, with the contention of the possibilities of complications; but so far I have not seen any.

COMPARATIVE VALUE OF VARIOUS BLOOD AND URINE EXAMINATIONS IN URINARY SURGERY*

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THE International Urological Society, an association of long standing, reorganized in 1919, is composed of members from the various countries throughout the world, such members being subjects of a state received in the League of Nations in 1919. The object of the Society is the study of all questions relating to urology, including anatomy, physiology, chemistry and medical and surgical pathology; a Congress is held every three years.

Up to the present time all of the meetings have been held abroad. The next Congress will be held in Madrid in 1930, and three years later it is hoped that the Congress will be held in New York City.

There is no limit to the number of guests that may attend the sessions, and although they do not take part in the scientific discussions, they are welcome to the meetings and all social functions incidental to them.

These meetings are unique both because of their international character, the high standard of the scientific papers and clinical work presented, and also because of the unusual settings and social features.

The meeting held this summer in Brussels was no exception, for the city, abounding in historic and artistic treasures, was thrown open to us and we were privileged to view many priceless collections, interesting buildings and homes not seen by the regular visitor to the city.

The hospitality of our hosts was unbounded and genuine, their entertainments interesting and dignified, and their scientific work serious and well executed, so that we came away feeling enlightened, broadened in our viewpoint, pleased with new acquaintances and the opportunity that we had had of discussing our problems with them, and looking forward to the next meeting, three years hence.

As Americans we were justly proud of our representatives—Dr. Keyes, never at a loss to do the right thing at the right time, upheld the standard and dignity of American urology by his address at the opening of the Congress, his scientific discussions, his familiarity with continental customs, fluency in French and ever-present humor; and we are all proud of his election as the permanent President of the Society.

Dr. Beer was awarded the gold medal of the Society in recognition of his splendid work on the treatment of bladder tumors, which was characterized as "the best piece of work in recent years in the advancement of urology."

These honors were well deserved and characterize American urology, placing it second to none. Both in their papers and in their clinical work it seems to me that the men in this country approach urological problems with a much more clear-cut, definite, unprejudiced mind, get down to facts sooner and apply their knowledge to better advantage, yet never losing sight of the welfare of the patient, their first consideration. This was apparent in the first group of papers on the subject of "The Comparative Value of the Various Examinations of the Blood and Urine in Urinary Surgery." H. Chabanier of Paris read the first paper on this subject: "The Comparative Value of Different

* A Report of a Symposium at the International Urological Society, held in Brussels, August 3–6, 1927. Presented before the New York Urological Society on October 26, 1927.

Methods of Examination of the Blood and Urine in Urinary Tract Surgery."*

SUMMARY OF H. CHABANIER'S PAPER

The author first considered various methods for determining the total renal function:

1. Urine analysis.
2. Determining the excretion of certain substances introduced into the organism: the phenolsulphonephthalein test.
3. Determination of certain chemical substances in the blood, especially the blood urea.
4. Special tests based on Ambard's method.

The determination of the amount of various substances, especially urea, excreted in the urine is not sufficient to determine renal function. Extrarenal metabolic factors affect the elimination of different substances. With urea and other nitrogen products, the organism tends to maintain nitrogen balance; when the kidneys are diseased, the balance is attained more slowly.

The excretion of certain substances such as phenolsulphonephthalein, is also influenced by extrarenal factors. The excretion of phenolsulphonephthalein depends not only on renal function, but also on the condition of the circulation and the liver function, as recent investigations have shown.

The value of the determination of blood urea as a measure of renal function was first demonstrated by Widal in 1904. This was the basis for the subsequent work of Ambard, who determined the formula for the "ureo-secretory constant," a urea index as an index of kidney function. Ambard found that, other things being equal in regard to renal function, the blood urea values vary directly with the excretion of urea in the urine; also that, other things being equal in regard to urea excretion, the blood urea values vary directly with the degree of alteration in the kidneys.

* International Society of Urology, Third Congress, August, 1927. Vol. 1, pp. 89–179.

In comparing the blood urea values and the Ambard urea index in a large series of patients, Chabanier found that with blood urea values below 1 gm. per 1000 c.c., the variations in blood urea do not indicate the true renal function as shown by the urea index. Blood urea values constantly above 1 gm. were a practically certain indication that the renal function was about 10 per cent of normal.

Chabanier then discussed the work of Ambard and the laws on which the determination of his formula was based. He stated that Ambard has shown that the constant determined by his formula is independent of the intensity of nitrogen metabolism, whether much or little urea is elaborated by the organism. It depends both on the quality and quantity of the functioning renal parenchyma.

Ambard and Papin have also pointed out the importance of the maximum concentration of urea; if the volume of urine diminishes, while the quantity of urea produced by the organism increases, the concentration of urea in the urine will increase, but not above a certain value, one which is called the maximum concentration. This maximum concentration of urea may be determined by giving 5 to 6 gm. of urea every half hour and determining the concentration of urea in the urine at the same interval, until this concentration remains at practically the same level. This procedure, however, sometimes causes nausea, and sometimes produces a diuresis which makes it impossible to determine the limit of concentration.

Another procedure proposed by Legueu, Ambard and Chabanier gives better results. This is to give the patient the curd of 3 liters of milk each day without other food and with a limited amount of fluid. The concentration of urea in the urine is determined daily until a fairly constant level is reached. The test may be carried out for four or five days, but in nephritic patients two to four days is usually sufficient to establish the maximum concentration. In normal persons the maximum

concentration of urea in the urine is approximately 50 gm. per 1000 c.c.; with nephritic patients it is less. The maximum concentration of urea in the urine does not depend on the amount of functioning renal parenchyma, as has been shown in animal experiments and in man after nephrectomy. It depends on the quality of the functioning renal parenchyma.

In cases in which the urea concentration in the urine reaches its maximum spontaneously, i.e., under the patient's ordinary conditions of life, this concentration cannot increase even under such special circumstances as produce a change in the volume of urine. Any decrease in volume results in a diminution in the amount of urea excreted and in urea retention in the blood. When such a maximum concentraction of urea in the urine is reached and maintained, the excretion of urea ceases to depend on the amount of blood urea and becomes solely the function of the urinary volume, and Ambard's ureo-secretory constant is no longer applicable.

From these considerations, the author concludes that it is not possible to determine renal function solely by urine analysis. Tests of the elimination of certain substances introduced into the organism, such as dyes, depend on too many extra-renal conditions, not yet fully understood, to serve as accurate tests of renal function. The determination of blood urea alone without control of all factors of nitrogen metabolism does not indicate the renal function exactly, unless the blood urea value is constantly above 1 gm., in which case the renal function is less than 10 per cent of the normal. The determination of Ambard's ureo-secretory constant indicates the actual function of the kidneys, except in cases where the maximum concentration of urea in the urine is attained. In such a case this maximum concentration must be determined. The latter condition should be suspected in cases with a diminished volume of urine, a low value for urea excretion, and a rapidly increasing blood urea. In other cases with blood urea below 1 gm. the Ambard ureo-secretory constant should be determined.

In determining the function of each kidney separately by ureteral catheterization, Chabanier has found that the determination of the volume of urine obtained from each kidney is not a true indication of the function. The comparison of chloride excretion also is not of value, as the question of renal threshold for chloride complicates this determination. The best method for determining the function of the kidneys separately is a study of the urea excretion by each kidney. Both the total urea excretion and the urea concentration in the urine from each kidney are determined, a method of catheterization being used which permits collection of the urine filtering out along the ureteral catheter from each kidney.

The kidney which shows the higher concentration of urea and also excretes the larger volume of urine has the better function; but if the kidney with the higher concentration of urea excretes the less urine, this determination is not of value, as the difference in concentration may be due only to the difference in volume.

If the kidney that excretes the greater amount of urea also excretes the smaller volume of urine, it has the better function. If neither of the two conditions of higher concentration of urea and greater volume of urine, or of greater amount of urea and lower volume of urine be found for either kidney, the urea excretion for each kidney must be calculated for a standard concentration, 25 gm. per 1000 c.c. The urea excretion of each kidney calculated at 25 gm. per 1000 c.c. indicates the function of each kidney.

The determination of the excretion of various substances, not normal constituents of the urine, after the ingestion or injection of these substances, such as phenolsulphonephthalein, is not so good an indication of the relative function of the two kidneys, either from a theoretical or a practical viewpoint.

The absolute function of each kidney can be determined in the same way as the total renal function, i.e., either by determining the Ambard ureo-secretory constant or by determining the maximum urea concentration for each kidney. The determination of the Ambard constant for each kidney involves a difficult technique and is not to be recommended for practical clinical purposes. The determination of the maximum urea concentration of each kidney is not open to this objection.

A surgical operation may result in urea retention of varying severity, sometimes so severe as to cause death. Neither the probability of such a crisis of nitrogen retention nor its severity can be predicted by any of the tests of renal function based on the various methods of blood and urine analysis now used in urology. It has been found that a severe crisis of nitrogen retention may follow operation on a patient who before operation had a normal Ambard constant, while a patient who showed a low constant may develop no such crisis after an equally severe operation. The author notes that a crisis of nitrogen retention is less likely to develop after nephrectomy than after certain other genitourinary operations, especially prostatectomy. This is due to the fact that in most cases of nephrectomy the maximum urea concentration in the urine of the remaining kidney is usually normal, indicating a qualitatively normal function. But, as a rule, in spite of the fact that the methods of determining renal function are scientific and precise, there is not such a precise method for estimating the prognosis as to the effect of operation on renal function.

SUMMARY OF DR. QUINBY'S PAPER

In contrast to this presentation of ninety printed pages, only a short summary of which I have given, was the paper of Quinby of Boston, which clearly and concisely gave an estimate of the value of tests of blood and urine in urological surgery as generally accepted in this country.

Quinby said that, in considering the function of the kidney from the clinical point of view, we are accustomed to view this organ in its purely excretory aspect, dealing with the transfer of a substance from the blood on the one side to the urine on the other. We know that, as one of the main parts of bodily metabolism, the kidney is engaged in a large measure in removing the end-products of the protein metabolism; the study of these nitrogenous end-products has made it certain that though the amount of urea, for instance, excreted by each healthy kidney is the same during any single time interval, in disease the amount excreted varies in almost direct proportion to the degree of injury in one or the other organ. The tests for renal function used in surgery are based on these facts: that a diseased kidney is incapable of excreting solids; and that the degree of impariment of this function is parallel in a general way to the degree of existent disease.

Tests of renal function should be simple for both surgeon and patient to perform, and should be accurate and delicate enough to demonstrate clearly the degree of damage to the kidney parenchyma.

After giving a brief history of the various tests of renal function, he cites extensive experimental work carried out in conjunction with Dr. Reginald Fitz, and concludes that we are today estimating the function of kidney by the phenolsulphonephthalein test, while for the estimation of the state of general protein metabolism we rely on the determination of the amount of urea in the blood. He states that two procedures brought out since this experimental work, namely the coefficient of urea excretion of Ambard and the urea concentration test of MacLean, have now little approbation in America, and as regards their accuracy and applicability, both are questioned when compared with the above.

Quinby described the technique of the phenolsulphonephthalein test for combined as well as separate kidney function, and

the curve of excretion as described by Shaw, with its interpretation. The estimation of blood urea serves in all cases as a means of comparison with the result of the phenosulphonephthalein elimination, and often when the urine cannot be accurately collected free from a mixture of blood, as just after prostatectomy, it gives information of much importance as regards the progress of the patient towards recovery.

These tests, being simple and relatively easy of performance, should be carried out at frequent intervals, he stated, for it is of much more value to know how much progress the patient is making and is capable of than to know what the kidneys are doing at any specific time.

In conclusion he expressed complete agreement with Young, that laboratory tests of renal function have given rise to endless discussion which is largely due to misunderstanding, the facts being that laboratory tests supplement but do not replace direct observation of the patient; that the additional information gained from laboratory tests is indispensable, and that no single test proves anything but is merely another element in the complete clinical picture we are trying to construct.

OTHER DISCUSSIONS

In discussing these papers fourteen members took part, each reading a summary of his views on the subject regardless of the formal papers presented, no reference being made to the arguments set forth by the writers of the papers previously delivered. There was very little brought out by the continental members that was clear cut. They seemed to depend more on Ambard's constant as a measure of kidney function and to be unfamiliar with the phenosulphonephthalein test, although some occasionally employed it. Thompson Walker depended entirely upon the comparison of the urea estimation of the blood and urine in his decision as to whether operation were justifiable and in estimating the prognosis in any given case.

Keyes summed up his views as follows: what the kidney has done is best determined by blood chemistry, what the kidney is doing by the phenosulphonephthalein test, and what the kidney will do by repetition of both and by concentration tests. In estimating the prognosis in urinary surgery no tests are of value, but it is best determined by the general condition of the patient. Brains alone will determine when or when not to operate.

Beer very clearly expressed his views regarding the value and necessity of the various tests of kidney function in urinary surgery, giving the particular virtues of blood chemistry, the indigocarmine test and phenosulphonephthalein estimations. He emphasized the sense of security given by such information.

In my discussion of the subject I cited clinical cases illustrating the inaccuracy of depending solely upon the estimation of blood urea as a test of kidney function, and also phenosulphonephthalein elimination alone, but the great value of the two when used together, and the necessity of repetition in eliminating technical errors and denoting progress, as well as in estimating progress. Other cases were mentioned emphasizing the value of the curve of phenosulphonephthalein elimination suggested by Shaw. The necessity of following the clinical signs and symptoms closely was emphasized and the rôle of functional tests assisting in diagnosis, especially in the absence of clinical manifestations and positive cystoscopic and urographic studies, was brought out; and I concluded with the statement that these tests of function should coincide with our clinical observations, cystoscopic and urographic studies giving us data which, with full knowledge of their limitations, complete the picture, and that they should be utilized at all times in diagnosing, outlining prognosis and in treating urological lesions.

TISSUE CULTURES

IN TWO CASES OF INTERSTITIAL CYSTITIS*

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I WISH to report the growth in pure culture of a streptococcus, from the tissue removed at operation in two cases of interstitial cystitis.

It has always been the consensus of opinion that interstitial cystitis is infectious in origin, probably secondary to some distant focus, and Hunner, Kretchmer and Keene have, in their clinical reports, taken great pains to trace, through exhaustive histories and careful physical examinations, evidence of a primary focus, with especial reference to the teeth and tonsils. These efforts have not been sufficiently successful to be conclusive.

Experimentally, very little has been done, with the exception of the work of Bumpus and Meisser, who report the production of lesions in the urinary tract, both in the bladder and kidney, following the intravenous injection into rabbits of a green producing streptococcus obtained from the teeth or tonsils of patients having interstitial cystitis. These experiments parallel very closely those of the same authors on pyelonephritis. In these cases a green producing streptococcus obtained from the teeth and tonsils of the patients was injected into rabbits, and produced lesions in the kidney and bladder. The organisms used in these two sets of experiments were so similar, as were the lesions produced in the animals that it would seem that more definite differentiation is necessary, in so far as the reproduction of interstitial cystitis is concerned. They did, however, demonstrate a diplococcus in the tissue removed from the patient's bladder, and Hinman, in his discussion of that paper, reported the culture of a streptococcus in one case, and proteus vulgarius and a colon bacillus in two others.

The two cases which I am reporting are of interest only because the same organisms were obtained from each. The first case is that of a woman forty-seven years old whose history was essentially negative for previous infectious diseases. Her bladder symptoms, consisting of frequency, urgency and pain, had been present for fifteen years. Her general physical examination was negative, except for several infected teeth. Urological examination revealed the urine to be clear, and free from infection. Cystoscopy showed the bladder capacity to be 250 c.c. On inspection the entire bladder mucosa was normal, with the exception of a spot on the anterior wall just behind the vesical orifice. At this point there was a well-defined submucous hemorrhagic area about 1 cm. in diameter, over which the mucous membrane was intact. It was well defined, and the mucous membrane surrounding it was normal. Both ureteral orifices were normal, and were seen secreting clear urine. They were readily catheterized, and urine sterile to culture was obtained. Functional tests and roentgen rays were normal. At a second cystoscopy the patient was anesthetized, and the bladder readily distended to 480 c.c. With this dilatation there were seen on the anterior wall of the bladder, in the region of the lesion described above, other lesions typical of interstitial cystitis. These were five in number, and all situated within 2 cm. of each other. They were fulgurated, but without relief to the patient, so resection was done.

At operation small pieces of the ulcerated areas were carefully placed in banana medium. On the third day a smear showed a pure culture of a streptococcus whose

* Read before the New York Academy of Medicine, Section of Genito-Urinary Surgery, October, 1927.

characteristics I will outline after presenting the second case, since the organisms obtained in the two were culturally identical.

The second case is that of a woman forty-five years old who had been having frequency, urgency, and burning pain on voiding for several years. She had had a previous diagnosis of interstitial cystitis and a bladder resection elsewhere, with partial relief of symptoms. There was no history of previous infections.

At cystoscopy the bladder capacity was 180 c.c. The bladder urine was free from infection, as was that from both kidneys. On inspection the entire bladder mucosa was negative, except that on the right lateral wall about 3 cm. above the ureteral orifice there was seen a well-localized area of redness, over which the mucous membrane was intact, and surrounding which the mucous membrane was normal. The trigone also was normal. Under anesthesia the bladder was distended readily to 350 c.c., and in the region of the reddened area described above there was demonstrated a typical lesion of interstitial cystitis. This was resected, and the tissue removed dropped into banana medium.

In both of these cases at the end of three days there was obtained a pure culture of a very fine streptococcus. This was planted on blood agar and grew very slowly. The colonies at the end of forty-eight hours were barely visible, and at the end of three days appeared as very small, opalescent, almost dew-drop colonies. There was no hemolysis or green production.

The cultures were injected directly into the bladders of two dogs in each of the cases, and after two months the dogs were autopsied. No definite lesions were present at the site of the injections.

While it is reasonable to assume that the lesions in these two cases were caused by the organisms obtained, it is not to be inferred that this is the cause in all cases, unless the same bacteria can be obtained from a larger group of cases. The failure to reproduce the lesions experimentally may be due to several factors. The organism may not be virulent in dogs. Also, the lesion is one which develops very slowly, clinically, and it is common for patients to give a history of having had symptoms for many years, and so it may be that it is necessary to let the experimental animals go much longer before examining the bladders. Another consideration is that the production of the lesion may be dependent upon the constant supply of bacteria from a distant focus, which would not be obtained in a single injection.

These cases are of interest chiefly because the same organism was obtained from each.

DISCUSSION

Dr. H. D. Furniss: I wish Dr. Bidgood had gone further into some theory as to the possible origin of the streptococcus, and whether he found it in other portions of the body. I have had a number of these Hunner ulcers and have tried to eliminate infection in other portions of the body, by removal of tonsils, teeth, etc., with no effect on the ulcerations. In many cases one sees scars of an ulceration that has healed. Cases may be treated by fulguration or resection, and may or may not have a recurrence. Unless great care is taken in a resection of the bladder it is apt to be done insufficiently, and if, on the other hand, a sufficient amount is removed, it makes the operation formidable and leaves a very small bladder. Many men seem to doubt that there is such a thing as Hunner ulceration; it is my experience that unless you are very careful and have a brilliant light you are apt to overlook them. I have been impressed with the fact that the cases I have fulgurated in one hospital have done much better than those similarly treated in another hospital. The only variable factor that I know of in these cases is that in the one hospital the primary alternating current is taken directly from the street main and in the other it is taken from a direct current and transformed into an indirect current.

Dr. N. P. Rathbun: The paper illustrates one thing very forcibly, that is, the difficulty

of making streptococcus cultures. Often you can get a positive culture from the tissue itself. I have, however, in a few such cases by a very careful culture method forced the streptococcus to show, and in some of these cases I have found the same type of streptococcus in the teeth and tonsils—and the cases were cleared up by removing the foci. I have watched some of these cases over a period of years and have seen the ulcers heal in one place and reappear later in some other part of the bladder, with or without fulguration or other lines of conservative treatment. It would seem as if there must be some bacterial origin.

Dr. C. Y. Bidgood: To answer Dr. Furniss's question regarding search for remote foci of infection, in the first case, several infected teeth were removed and cultures made, following Rosenow's technique. A mixed infection was demonstrated, with some streptococci among them; but they were not of the type obtained from the bladder lesion. The second case had had her tonsils removed previously, and no infected teeth were demonstrable.

A COLLECTIVE REVIEW OF STILL-BIRTHS IN THE LONG ISLAND COLLEGE HOSPITAL MATERNITY SERVICE IN THE YEAR OF 1926 WITH THE AUTOPSY FINDINGS, AND AN EXPLANATION OF FETAL MACERATION

By John Osborn Polak, M.D., F.A.C.S. and David Beres

NEW YORK

DURING the year 1926 there were 780 deliveries in the inpatient service at the Long Island College Hospital, with 39 stillbirths. These figures include nine premature macerated fetuses weighing less than 1200 gm., and three congenital anomalies. The following review is made of these still-births to ascertain the cause of death and to compare the findings with similar studies by various authors in America and Europe. The pathology of fetal death will also be discussed.

One must begin with definitions. A stillborn infant, strictly speaking, is one born alive, as is evident from the beating heart, but not breathing and therefore lying still (Ballantyne[1]). An infant actually born dead is in strict parlance "dead-born." The distinction between stillborn and dead-born is not made in this study, but should be kept in mind. Death in the newborn is conveniently spoken of as of 3 forms: antenatal, intranatal, and neonatal, according as death occurred before the onset of labor, during labor, or within a short period after birth. An accurate analysis of the infant mortality of an obstetrical service requires a consideration of all these types of cases. This is obvious, since many neonatal deaths occurring in the first few days of life are due to conditions for which the obstetrician is responsible.

Unfortunately the present review does not include neonatal deaths, and its accuracy must suffer thereby. The infant death rate of 50 per 1000 calculated from the figures given in the first paragraph, gives too high an incidence of still-births if the prematures and congenital anomalies are included and too low an estimate of the mortality on the obstetrical service at this hospital, since neonatal deaths are not considered.

CAUSES OF FETAL DEATH

It is often very difficult to decide the primary cause of death in an individual case. This will become evident in the detailed discussion of the cases in this series. In a case of transverse presentation, for example, the child may die because of prolapse of the cord. Here transverse presentation is taken as the primary cause of death since the prolapse of the cord was favored by the abnormal presentation. Such arbitrary distinctions may leave room for disagreement, but the reason for the choice will be indicated in each case.

To facilitate later comparisons, it is best to adopt the etiological classification of dead-births and neonatal deaths given by Holland and Lane-Claypon[2] in their exhaustive treatise on the topic:

DEAD-BIRTHS AND NEONATAL DEATHS: ETIOLOGICAL CLASSIFICATION

1. Complications of Labor
   - Contracted pelvis
   - Transverse presentation
   - Breech presentation
   - Prolonged or difficult labor in:
     - Face presentation
     - Brow presentation
     - Vertex Occipitoposterior presentation
     - Vertex Occipitoanterior presentation
   - Difficult forceps delivery
   - Excessive size of fetus (including post-maturity)
   - Premature rupture of membranes

Precipitate labor
Prolapse of cord
Coiling of cord round fetus
Dystocia of indefinite cause
Normal labor
With excessive cranial stress
With asphyxia
Others

II. Ante-Partum Hemorrhage
Placenta Previa
Accidental hemorrhage

III. Toxemia of Pregnancy
Eclampsia
Albuminuria of pregnancy

IV. Syphilis
Certain (i.e., spirochetes found)
Probable
Possible

V. Maternal Diseases
Chronic renal
Cardiac
Tuberculosis
Pneumonia, bronchitis, empyema
Intestinal obstruction
Epilepsy
Others

VI. Placental States
Excessive red or white infarction
Retroplacental hematoma
Other placental degenerations
Excessively small placenta

VII. Fetal States (excluding syphilis)
Hydrocephalus
Anencephaly
Spina bifida
General edema of the fetus
Other deformities
Multiple pregnancy
Hydramnios
Others

VIII. Prematurity

IX. Cause Unknown

X. Deaths Due to Postnatal Causes

XI. Insufficient Information

XII. Non-viable Cases

Following the above classification the causes of death at the Long Island College Hospital may be summarized thus:

TABLE 1

Cause	Number	Per cent
I. Complications of labor	12	30.7
II. Antepartum hemorrhage	4	10.3
III. Toxemia	3	7.7
IV. Lues:		
Certain	0	0
Probable	3	7.7
Possible	8	20.4
V. Maternal disease	1	2.6
VI. Placental States	1	2.6
VII. Fetal states	3	7.7
VIII. Insufficient information	4	10.3
Total	39	100.0

The outstanding fact in this summary is that the greatest single cause of fetal death is the complications of labor. This finding agrees with that of all authors who have written on the topic. One notices that not a single case of certain syphilis is recorded. A death can be ascribed to syphilis with certainty only if the Spirochaeta pallida is found in the tissues of the infant. Since the organism was not sought for in this series, certainty is not warranted. Death was ascribed to probable syphilis when the mother had a positive Wassermann with a history of repeated miscarriages. Possible syphilis was ascribed to cases in which the pathology of the placenta or the obstetrical history of the mother pointed to syphilis. The Wasserman in these 8 cases was negative in 7 and not recorded in the other.

One is impressed by the large percentage of cases in which the cause was not determined; these were classed under "Insufficient information" because autopsy studies, if done, with a search for the Spirochaeta pallida would have made possible the proper classification of most of these cases. Only one autopsy was done in the entire series. The pathological report regularly contained the statement "fetus macerated, autopsy not done." But as Ballantyne[1] points out, maceration is the basis of the study of antenatal pathology. "The custom of saying that because the foetus was macerated there was no use in examin-

ing it microscopically or bacteriologically must be abandoned." The absence of autopsy findings in the present series will make it necessary to base the discussion on pathology entirely on the literature.

Before proceeding to a detailed consideration of the individual cases in this series it is well to point out the information desired in each case. Holland[3] and Thomson[4] have both given lists of data desired, of which the following is a compendium:

I. With Reference to the Mother.

1. Age, and whether married or single
2. Enquiry into economic conditions
3. History of previous health, with special reference to infection with syphilis or gonorrhea
4. Previous obstetrical history
5. Health during present pregnancy
6. Duration and type of present labor
7. Wassermann reaction
8. Gonococcal complement-fixation reaction

II. With Reference to the Father.

1. History of health with special reference to infection with syphilis or gonorrhea
2. Wassermann reaction
3. Gonococcal complement-fixation reaction.

III. With Reference to the Fetus.

1. Description of the naked-eye appearance of the cadaver and its organs, with notes of weight ratios and measurement, and calculation of the fetal age from the centers of ossification
2. Examination of the cranium with special reference to tears of the dural septa, and to hemorrhage into the lateral ventricals
3. Preparation of sections of the viscera for histological examination
4. Examination of the principal organs by the Levaditi method for the Spirochaeta pallida
5. Naked-eye and microscopical examination of the placenta with record of weight-ratio and notes upon the condition of the umbilical cord and membranes.

Most of the data called for in an ideal study of fetal death will not be found in the following cases.

SUMMARY OF CASES

Case I (Hospital Case No. 49.) Death due to *premature rupture of membranes*. Mother, aged forty-two, admitted with diagnosis of nephritic toxemia. Four other children living and well. Blood pressure, systolic, 190, diastolic, 94 at delivery. Treated before delivery with magnesium sulphate and milk diet. Wassermann was negative. The position was right occipitoposterior. The membranes ruptured on January 3, 1926 at 11:00 A.M. Pains began on January 6, 1926, at 1:00 A.M. By 2:00 A.M. pains were coming every five minutes. Much meconium appeared, though the fetal heart was still heard. At 3:45 A.M., the infant was born dead, apparently asphyxiated for some time. The toxemia in this case seems to have had nothing to do with the death of the infant.

Case II. Death due to *transverse presentation*. Mother, aged forty-one with one child living and well, and one miscarriage at seven weeks admitted with diagnosis of right scapuloanterior. At 8 A.M. the fetal heart was heard. At 10:15 A.M. the cord prolapsed, the fetal heart still being heard. At 10:30 A.M. an attempt at replacement failed. Version was attempted and the foot pulled down. The fetal heart was not heard. A retraction ring was formed. A cesarian section with hysterectomy was done. Pathological examination of the uterus showed a partial placenta previa, acute amniotis, acute decidual endometritis, and mural lymphangitis. Here, despite the numerous complications, death of the fetus may be ascribed to the abnormal presentation.

Case III. (Hospital Case No. 439.) Death due to *transverse presentation*. Mother, aged forty, was a septipara, with two miscarriages. Signs pointed to nephritic toxemia and polyhydramnios. Albumen was present in the urine and the blood pressure was systolic 140, diastolic 80. The position of the child was right scapuloanterior.

The membranes were ruptured, version done and followed by extraction. Death was ascribed to the malposition.

Case IV. (Hospital Case No. 243.) Death due to *breech presentation*. Mother, aged twenty-two, primipara, position was left sacroposterior. Extraction was done on the indication of an irregular, slow heart.

Case V. (Hospital Case No. 319.) Death due to *breech presentation*. Mother, aged twenty-four, primipara. Position was left sacroposterior. Up to 6:30 P.M. the fetal heart

was heard. At 7:55 P.M. Pinard's maneuver was done. A loop of coil around the left leg was found. The fetal heart became slow and irregular. The infant was extracted but could not be resuscitated.

Case VI. (Hospital Case No. 581.) Death due to *breech presentation*. Mother, aged twenty-six, was a tripara; the position was right sacroanterior. The fetal heart was irregular on delivery. Pathological study shows atalectasis and congestion of lungs and diffuse round cell infiltration of the liver. There is insufficient data to allow of definite disposal of this case, although it most probably belongs under complications of labor, death being ascribed to the breech presentation.

Case VII. (Hospital Case No. 518). Death due to *coil around neck*. Mother, aged seventeen, primipara. The position was left occipitoanterior. The fetal heart was slow during the first stage and was lost with the cervix dilated 4 cm. A coil around the neck was accepted as the explanation of the asphyxia.

Case VIII. (Hospital Case No. 629.) Death due to *complete twists in cord*. Mother, aged twenty-five, primipara. No evidence of syphilis or toxemia. Baby was born on October 7, 1926, and the fetal movements had not been felt since August 2, 1926. The infant was macerated, and a brown fluid with an offensive odor was discharged. The cord showed 19 complete twists, which was accepted as the cause of death. The placenta measured 14.5 by 9 by 0.8 cm. The membranes were gray-brown. Zonal infarcts were present on the amniotic surface and old infarcts on the maternal surface. The cord was brownish and edematous. Microscopically there was sclerosis of the villi. Syphilis cannot be ruled out with certainty in this case.

Case IX. (Hospital Case No. 655.) Death due to *true knot in cord and one coil around neck*. Mother, aged forty-two, primipara. The fetal heart was heard up to full dilatation. It was slowed by application of the abdominal binder, which was therefore removed. After one and one-half hours on the perineum the fetal heart was lost, low forceps were applied and at birth the condition described above was found.

Case X. (Hospital Case No. 706.) Death due to *prolapse of cord*. Mother, aged thirty-five, admitted gonorrhea and pelvic inflammatory disease. She had one living child, and had had two miscarriages twelve and six years ago at three and six months. The position of the baby was right occipitoanterior. The fetal heart was heard up to a 5 cm. dilatation of the cervix, when the cord prolapsed. The cord was reposited, but the fetal heart was not heard. Low forceps were applied.

Case XI. (Hospital Case No. 334.) Death due to *prolapse of cord*. Patient, aged forty, quintipara. The position was right occipitoposterior. There was a complicating marginal placenta previa which seems not to have affected the course of events. The cord prolapsed when the cervix was 2 cm. dilated. In one-half hour 2 loops prolapsed again and the fetal heart was no longer heard.

Case XII. (Hospital Case No. 408.) Death due to *contracted pelvis*. Mother, aged eighteen, primipara, had simple flat pelvis. There was also evidence of nephritic toxemia but this did not affect labor. The position was right occipitoanterior. After the cervix was fully dilated for two hours the fetal heart became irregular and then stopped. Low forceps was done.

Case XIII. (Hospital Case No. 62.) Death due to *accidental hemorrhage*. Mother, aged forty-three, has had fourteen children, of which only three are living. She was five months pregnant. Onset was with pain over the pubes and profuse vaginal bleeding, later with cessation of the pain. A vaginal pack did not help. A Braxton-Hicks version was done and followed by extraction. A discharge of old blood followed this. The uterus was packed. The fetus measured 36 cm. and was grossly normal. The placenta was discoid in shape and measured 15 by 13 by 0.5 cm. The fetal surface was normal and the cord laterally inserted. Cord and membranes were normal. Microscopically the amnion was normal. Subjacent to the chorion was a broad hemorrhagic zone of recent origin. This zone was intervillous. The villi had only the syncytial layer of epithelium. There were a few Hofbauer cells. On the maternal surface was a red infarct. The villi had undergone advanced degeneration and were matted by fibrin. The pathological diagnosis was: (1) subamniotic hematoma; (2) red infarct; (3) congestion.

Case xiv. (Hospital Case No. 192.) Death due to *placenta previa*. Mother, aged thirty-three, with one other child, was brought in an ambulance because of painless hemorrhage. The fetal heart was heard on admission. A Braxton-Hicks version was done. The child was delivered in a spontaneous right sacro-anterior presentation, but was dead. The membranes at the margin of the placenta were torn from the surface. At one margin there were numerous torn cotyledons and peripheral blood vessel clots.

Case xv. (Hospital Case No. 462.) Death due to *placenta previa*. Mother, aged thirty-five, nonipara. Diagnosis of marginal placenta previa was made. The insertion of an extra-ovular bag did not help. The fetal heart was heard until version was done. It then became irregular and after two hours ceased.

Case xvi. (Hospital Case No. 603.) Death due to *placenta previa*. Mother, aged thirty-eight, duipara. In this case as in the previous one the fetal heart was satisfactory until version was done. It then became irregular and after one hour was lost.

Case xvii. (Hospital Case No. 29a.) Death due to *eclampsia in mother*, who was a primipara aged twenty. The patient was admitted in coma. Her Wassermmann was negative. Blood pressure was, systolic 212, diastolic 100, and the urine boiled solid. The fetal heart was not heard. The patient delivered a macerated, premature infant. The cord was centrally inserted. The placenta was congested but showed no special pathology. There were no infarcts.

Case xviii. (Hospital Case No. 206a.) Death due to *preeclamptic toxemia*. Mother was a primipara of thirty-eight. She had had two miscarriages four and six years ago at three and six and one-half months. The fetal heart was not heard. Patient delivered a seven-month macerated infant. One portion of the placenta near the periphery was normal. The rest was smooth. There were 2 infarcts. The cord was inserted eccentrically.

Case xix. (Hospital Case No. 337.) Death due to *toxemia of mother*. Mother, aged thirty, with a history of one other child also born dead, and of three miscarriages at three months, was admitted with a diagnosis of toxemia. The Wassermann was negative. Blood pressure was systolic 140, diastolic 106. The fetal heart was not heard. The patient delivered a premature, macerated infant. The placenta was eccentric and had numerous areas of fibrosis. In this case syphilis has not been positively ruled out.

Case xx. (Hospital Case No. 495.) Death due to *syphilis*. Mother, aged twenty-three, with one other child, gave a history of a 3 plus Wassermann. She had felt no fetal movements for one week. The patient delivered a seven-month macerated infant. The placenta was heavy, friable and whitish. The cord was eccentrically inserted.

Case xxi. (Hospital Case No. 514.) Death due to *syphilis*. Mother, aged twenty-two, with one other child. Wassermann on one occasion was 3 plus, another time was negative, and at a third test was 3 plus. The mother had felt no fetal movements for three days. The patient delivered a seven-month, macerated infant. The placenta was friable, the cord eccentrically inserted.

Case xxii. (Hospital Case No. 634.) Death due to *syphilis*. Mother, aged twenty-four, had following obstetrical history: 1 stillborn at term, 1 stillborn at 6 months. 1 premature living and well, and 1 full-term died in two days. The first Wassermann was negative but on reexamination was 4 plus.

Case xxiii. (Hospital Case No. 236). Death possibly due to *syphilis*. Mother, aged thirty, had one living child eighteen months old, but has had no miscarriages. She has had gonorrhea. Wassermann was negative. The fetal heart was not heard. The patient delivered a six-months macerated fetus. The placenta was normal only in a very small portion. There were many infarcts which studded the entire placenta. The presence of gonorrhea and the absence of any other competent producing cause points to syphilis as the cause of death in this case.

Case xxiv. (Hospital Case No. 421). Death possibly due to *syphilis*. Mother, aged thirty-three, quadripara, had had three miscarriages at three months. The Wassermann was negative. The patient delivered a seven-month, macerated fetus. The placenta had degenerated cotyledons. The cord was eccentrically inserted. The series of miscarriages points to syphilis,

but the diagnosis could have been made more certain by more data.

Case xxv. (Hospital Case No. 459). Death possibly due to *syphilis*. Mother, aged twenty-six, has had 4 other deliveries as follows: 2 full-term infants died in five days, 1 full-term stillbirth, 1 miscarriage at five months. The Wassermann was negative, but patient had had gonorrhea ten years ago. Systolic blood pressure was 110 mm. and the urine was negative. No fetal movements were felt for five days. At delivery an impacted right occipito-posterior presentation required manual rotation of the head and shoulders. The infant was stillborn and macerated. The history in this case is very suspicious of syphilis despite the negative Wassermann.

Case xxvi. (Hospital Case No. 488). Death possibly due to *syphilis*. Mother, aged twenty-one, was a primipara who admitted gonorrhea and was not sure about not having had syphilis. The Wassermann was negative. For one week prior to delivery the patient had a brownish vaginal discharge, but no malaise or headache. She delivered a seven-month, macerated infant. The placenta measured 17 by 12 by 1 cm. The membranes were dull, prominent, and lusterless. Microscopically the amnion was seen to be poorly preserved. The subamniotic stroma was edematous. The villi showed sclerosis of the main-stem branches. Budding was prominent, the buds being small, knob-shaped, and sclerotic. The stroma was edematous. The pathologist did not make a definite diagnosis, but the history and pathological findings point to syphilis.

Case xxvii. (Hospital Case No. 542). Death possibly due to *syphilis*. Mother, aged twenty-nine, had had one other baby, also stillborn and macerated. Patient also had pyelitis. The fetal heart, according to the record, was heard on admission but was lost during the first stage. The fact that the patient delivered a macerated fetus (six months) makes it doubtful whether the fetal heart was really heard. Syphilis is indicated as the possible cause of death on account of the history. There is no record of a Wassermann.

Case xxviii. (Hospital Case No. 705). Death possibly due to *syphilis*. Mother, thirty-four had 3 miscarriages and 1 other stillborn infant. The Wassermann was negative; blood chemistry was negative; systolic pressure was 114 mm. Patient delivered six months macerated infant with a bilateral hare-lip. The placenta showed some infarcts and fibrous cotyledons. The membranes were gray-brown. The cord was eccentrically inserted. Microscopically there was sclerosis of the villi with few vessels. The decidua compacta was fused in one area with villi. History and pathology point to syphilis.

Case xxix. (Hospital Case No. 726). Death possibly due to *syphilis*. Mother, aged twenty-six, has had three other macerated infants, one at five months, two at seven months. The Wassermann was negative. There was no fetal heart beat on admission. Patient delivered premature, macerated infant. The placenta measured 17 by 12 by 1 cm. and was hemorhagic in spots, though mostly pale. The cord was centrally inserted. The maternal surface was gray-white. Microscopically the amnion appeared well preserved. The amniotic stroma was edematous and infiltrated with neutrophiles. The chorionic villi were large and club-ended, the stroma edematous and sclerotic, and the blood vessels sclerotic. There was congestion of the decidual vessels. The pathological diagnoses of acute amniotitis and sclerosis of the villi (possibly lues) were made.

Case xxx. (Hospital Case No. 774). Death possibly due to *syphilis*. Mother, aged twenty-six, had had three miscarriages and probable history of gonorrhea. There was a trace of albumin in the urine and the systolic blood pressure ranged from 128 to 140 mm. A diagnosis of nephritic toxemia was entered on the chart. The patient delivered a five-month macerated infant. There was a placenta marginata with an eccentrically inserted cord. The amnion was brownish and there were no infarcts. Microscopically the amniotic epithelium was not preserved. The underlying stroma was edematous and the veins thrombosed. The villi were sclerosed with subintimal thickening of blood vessels, which were few. There was an edema and hydropic degeneration of the decidual cells. The cord was edematous. The history and pathological findings point to syphilis as a more probable cause of the stillbirth than toxemia.

Case xxxi. (Hospital Case No. 711). Death due to *renal disease in mother*. Mother, aged thirty-five, octipara had nephritic toxemia and a single kidney. The fetal heart was not heard

before labor. The patient delivered a seven-month infant.

Case xxxii. (Hospital Case No. 145). Death due to congenital malformation. Mother, aged thirty-six, sextipara. The fetal heart was lost in the first stage. The child had acrania-acepalus.

Case xxxiii. (Hospital Case No. 189a). Death due to *congenital malformation*. Mother, aged seventeen, was a primipara. The membranes were supposed to have ruptured three weeks before admission. The fetal heart was not heard. The infant when born was hydrocephalic and had club-feet. It may be that the early rupture of the membranes was responsible for the malformations, but the data on the chart is too scanty to permit an opinion. Death is therefore ascribed to the malformation.

Case xxxiv. (Hospital Case No. 206). Death due to *congenital malformation*. Mother, aged thirty-one, was a duipara. The fetal heart was not heard. The position was right sacroanterior. The fetal body was delivered up to the neck. The after-coming head was hydrocephalic and had to be perforated. The head was further malformed having small eyes and a single nostril. The Wasserman in the mother was negative.

Case xxxv. (Hospital Case No. 271). Death due to *retroplacental hematoma*. Mother, aged thirty-three was a tripara. The Wassermann was negative. Labor was induced by a No. 5 Voorhees bag and the patient was delivered of a four and one-half-month infant of 22 cm. in advanced maceration. The placenta was ovoid and measured 18 by 12 by 2 cm. The cotyledons were well formed, but the adherent compact layer of decidua lent a gray-white appearance to the surface. The membranes were dirty-brown and also covered with decidua. The fetal surface had a large central hematoma measuring 7 by 5 cm. and projecting 5 to 6 cm. beyond the surface. The hematoma was discrete from the chorionic substance. Microscopically the amniotic epithelium was normal. The subjacent stroma was edematous. The hematoma was fused with this layer but extended into the chorionic substance separating the villi, which were well preserved. The villi were frequently fused by fibrinoid deposits. The hematoma was sufficient cause for the death of the fetus, though, of course, the real problem is to find the cause of the hematoma.

Case xxxvi. (Hospital Case No. 622). Cause of death *unknown*. Mother, aged thirty-six, was a primipara. Wassermann was negative and the blood pressure systolic 140, diastolic 60. The fetal heart was heard three days prior to admission but not on admission. A full term macerated fetus was delivered. The placenta had a greenish hue, was thin, fibrous, and granular and had few small infarcts. There was insufficient data to determine the cause of death.

Case xxxvii. (Hospital Case No. 660). Cause of death *unknown*. Mother, aged thirty-six, was a primipara. The Wassermann was negative; the urine had a trace of albumin; the blood pressure was systolic 140, diastolic 96. The position was right occipitoanterior. The fetal heart was last heard over two weeks before admission. The infant was macerated; it measured 42 cm. and weighed 2400 gms.

Case xxxviii. (Hospital Case No. 758). Cause of death *unknown*. Mother, aged twenty-four, was a tripara. She was admitted by ambulance, with bleeding and spasmodic uterine contractions. There was a foul, brownish vaginal discharge. The patient had bronchitis and fibrinous pleurisy. The Wassermann was negative. The patient delivered a six-month, macerated infant. Death could hardly be ascribed to the bronchitis, since the fetus was macerated and must have been dead for some time. There is not sufficient data to permit a diagnosis.

Case xxxix. (Hospital Abortion No. 4). Cause of death *unknown*. Mother, aged twenty-two, had one other child living and well. She had a papular rash over the chest which was diagnosed as a possible chicken-pox. She delivered a seven month, macerated fetus. The maceration makes it probable that the acute condition was not the cause of the fetus' death.

A comparison of the findings in this series with the results of various workers in America and Europe reveal a remarkable similarity of results. Complications of labor stand out in almost every series as the most important single cause of fetal death. The significance of syphilis is interpreted variously. Thus Holland and the English workers think that syphilis as a cause of

fetal death has been overemphasized, while Williams of Johns Hopkins finds it of paramount importance. He admits that the large proportion of negroes in this series explains this difference. In the present series syphilis appears to be a more potent factor than in many other series, except those of Williams. However, so many of the cases in this series are unproven cases that conclusions should be made with great caution.

The following summary table allows of immediate comparison of the results of all workers which permit tabulation. Other results will be recorded separately.

TABLE III
PERCENTAGES OF DEATH (WILLIAMS, 1915)

Cause	Percentage
Syphilis	26.4
Dystocia	17.6
Various	11.2
Prematurity	7.1
Toxemia	6.5
Deformity	3.4
Inanition	3.3
Antepartum hemorrhage	4.9
Other causes	1.6
Cause unknown	18.0

One notes here the high figure for syphilis, which is almost exactly that of the present series. In a later study,[8] Williams analyzes the significance of syphilis as a cause of fetal death in greater detail. The following table is a summary of his 302 cases:

TABLE IV
PERCENTAGE OF DEATHS (WILLIAMS, 1915)

Cause	Per cent
Syphilis	34.44
Dystocia	15.20
Toxemia	11.55
Prematurity	10.59
Antepartum hemorrhage	13.89
Deformity	3.64
11 other causes	10.69
Cause unknown	8.61

TABLE II
PERCENTAGES OF DEATH BY CAUSES

	This Series	Holland[3]	Holland and Lane-Claypon[2]					Williams[7] (whites only)	Holt[5]	McQuarrie[6]	Thomson[4]
			London	Glasgow	Liverpool	Edinburgh	Cardiff				
I. Complications of labor	30.7	28.3	34.8	40.2	31.2	37.2	30.2	22.4	31.1	37.1	23
II. Antepartum hemorrhages	10.3	22.3	21.7	30.7	14.3	10.5	17.0	9.9	7.4	2.0	6
III. Toxemia	7.7	8.6	12.7	10.7	7.7	10.2	20.1	11.7	9.9	9.2	6
IV. Syphilis	28.1	15.3	7.7	7.0	8.6	11.1	8.5	12.8	8.3	15.5	15
V. Maternal diseases	2.6	....	5.9	2.5	2.0	1.5	0.8	....	....	....	12
VI. Placental states	2.6	8.6	0.9	0.0	2.0	1.7	1.5	17.2	23.8	5.2	6
VII. Fetal states	7.7	5.6	5.0	5.4	23.6	7.2	10.8	6.6	3.0	8.2	23
VIII. Prematurity	9.0	0.3	0.0	0.3	2.0	10.4	3.1	5.2	2.8	5.3	6
IX. Cause unknown	10.3	10.7	11.3	3.2	8.6	10.2	8.0	14.3	13.7	17.5	5

In estimating the significance of these figures one must remember the personal equation in assigning the cause of death to a given case. Thus the workers in Edinburgh assign 10.4 per cent of deaths to prematurity, while the workers in London found no cases due to prematurity. Such a discrepancy is probably in great part due to different opinions on similar cases.

The figures for the Williams cases given in Table II are only for whites. His full figures for whites and blacks in his 1915 series[7] of 700 fetal deaths follows:

Analyzing these figures according to whites and blacks, Williams found that syphilis was the cause of death in 12.12 per cent of the white cases and 45.23 per cent of the black. The incidence of syphilis among the whites was 2.48 per cent and among the blacks 16.29 per cent.

Cruickshank,[9] in a discussion of syphilis as a cause of antenatal deaths, believes it to be an important cause of death in the later months of pregnancy and not in the early months.

A comparison of the figures of different workers on syphilis is very difficult because the factor of treatment has not been analyzed. Thus it is not stated what percentage of syphilitic mothers in England received antenatal care and treatment as compared with the less tractable negro patients in Baltimore and Brooklyn. It is probable that syphilis is losing its importance as a cause of fetal death in England only because of the excellent antenatal care in practice there, and the low percentages reported should not be taken to mean that syphilis kills less babies than was once believed.

The importance of the antenatal care in syphilis becomes evident from analyses by Ballantyne[1] in England and Williams[8] in America. The former found that among 138 syphilitic mothers who were treated there were 7 stillbirths, a death rate of 50.7 per 1000, while among 33 syphilitic mothers not treated there were 20 stillbirths, a rate of 606 per 1000. Williams studied 421 cases with a positive Wassermann reaction; of these, 157 received no treatment, with the result that 52 per cent of the offspring were stillborn or syphilitic; 103 received inadequate treatment (2 or 3 injections) with 37 per cent dead or defective offspring; 163 received full treatment (4 to 6 injections) with 7.4 per cent of fetal syphilis.

With this evidence we close our discussion of syphilis as a cause of fetal death and turn to the other great single cause, the complications of labor.

As has already been indicated, Holland has especially emphasized the latter factor. The question arises here as to how these complications act to produce death. To what extent are the deaths preventable by more careful practice of the art of obstetrics? Holland[2] presents some significant data. He studied at autopsy the presence and nature of tentorial tears and compared the presence of tears with the amount of obstetrical operative procedure in each case. The following table summarizes his results:

TABLE V

PERCENTAGE OF TENTORIAL TEARS IN RELATION TO PRESENTATION AND METHOD OF DELIVERY (HOLLAND, 1926)

Presentation	Delivery						
	Spontaneous	Forceps		Version	Version and forceps	Cesarian section	Total
		Once	More				
Vertex anterior.	16.3	55.3	52.2	28.0	63.6	16.6	24.6
Breech.....	50.6	66.6	....	40.0	.....	....	55.7
P. O. P.....	33.3	44.4	80.0	....	66.6	....	50.0
Face.....	33.3	66.0	....	50.0	.....	....	36.8
Transverse.....	....	....	....	37.1	100	50	35.7

One is at once impressed by the increase of tentorial tears with increased operative procedures, and by the great percentage of tears in breech presentations. The conclusions of Holland on these observations bear quotation:

> The frequency of intra-cranial lesions is high. Tentorial tears were noted in just over ¼ of all cases of fresh and neo-natal deaths in the entire series. Of these some were due to spontaneous breech labour, with, in some cases, difficulty in the delivery of the arms or head; but the majority were associated with the use of forceps or with the practice of podalic version.
>
> Although it is impossible to ascertain the precise factor which extinguished the life of the foetus or child it can hardly be doubted that the intra-cranial lesion with its accompanying hemorrhage was at least an important contributory cause of death. It appears therefore, that a high proportion of intra-natal mortality is due to manipulation of some kind or another. Such manipulation is often necessary in the interests of the mother or the child, but the present inquiry suggests that efforts should be directed toward the reduction of the need for obstetric interference.

Browne[10] arrives at conclusions similar to those of Holland. He found that cerebral hemorrhage occurred 10 times as frequently in breech presentations as it did in vertex presentations, and in the latter it is associated in most cases with the use of forceps.

Lyon[11] in a recent paper also emphasizes complications of labor as a cause of fetal death. His presentation of data, however, is so complex as to challenge all efforts at analysis.

The high proportion of tentorial tears in breech presentations leads Holland,[12] to suggest that as long as 10 minutes be allowed for the delivery of the head in breech cases.

THE PATHOLOGY OF FETAL DEATH

Two phases of the pathology of fetal death present themselves for analysis. The first is the nature of fetal death, the factors operating to cause the cessation of fetal life; the second is the nature of the changes going on in a dead fetus, or the process of maceration.

Of the first phase of the problem little can be said because little is known. The cause of fetal death in maternal toxemia, for example, is according to McIlroy[13] unknown. Strachnan[14] describes hemorrhagic lesions of the placenta associated with toxemia. These lesions are initiated by uteroplacental hemorrhage which produces sudden vascular injury. This gives rise to acute dilation of the chorionic blood vessels. The villi enlarge and the chorionic vessels rupture, giving the red infarct, which with time changes to the white infarct. These infarcts and intraplacental hemorrhages characterize toxemia as against syphilis, where according to Strachnan[15] there is neither infarction nor hemorrhage. To ascribe the fetal death in toxemia to placental insufficiency following these changes is not warranted, since there is no knowledge of what direct effect the poisonous products of toxemia (whatever they may be) have on the fetus. Holland[3] describes a toxemia neurosis of the liver, kidneys and other organs of the fetus in eclampsia. Similar findings are also described by Browne[10] while Thomsen[4] finds a congestion of the organs with small petechiae in the viscera.

The pathology of fetal syphilis is discussed in such detail in all textbooks that it will be dealt with very briefly here. The most important point seems to be to emphasize the value of a routine search for the Spirochaeta pallida in the tissues of the infants. The pathology of the placenta is well known. Browne[10] brings out the fact, which he says is little known, that in congenital syphilis enlargement of the spleen is a much more constant sign than enlargement of the liver. In the viscera the microscopic picture is that of an increase of the normal interstitial tissue. These changes are to be sought for in the thyroid, thymus, lung, pancreas, and other viscera, as well as in the liver and spleen.

We now proceed to a discussion of maceration, which, as Ballantyne points out, is the basis of fetal pathology. Maceration is not peculiar to syphilis. It is the method of degeneration of the tissues of the fetus under the aseptic conditions within the uterus, no matter what the cause of death. With this opinion there is unanimous agreement. Maceration is one of the most striking examples of autolysis, a process whereby the tissues are broken down by enzymes contained in the cell-bodies themselves. It is a process exactly similar to the changes occurring in the living body in cases of brain infarcts or tumors with central softening (Thomsen[16]).

In the present series maceration occurred in 19 cases out of the 39, divided by cause of death as follows:

TABLE VI

Causes of death	No. of cases
Syphilis	12
Toxemia	2
Retroplacental hematoma	1
Cord with twists	1
Unknown	3

Thomsen,[4] Strachnan[15] and Holland[2,3] also find masceration in cases due to numerous causes of death. The only common feature is that the infant should have been dead for some time, because, as Ballantyne[1] points out, if the death has occurred only a day or two before labor and birth, the macerative process may be so slight as to be unrecognized.

No description of maceration in the recent literature equals in clarity and conciseness that of the pioneer in this problem. The following description of maceration, written by Ballantyne[17] in 1902, has had very little added to it in twenty-five years.

The external appearance and the internal alterations of the macerated foetus vary with the period which has elapsed since death. The process consists in a gradual softening of the tissues of the body without the development of putrefactive gases or the presence of microbes; it is an aseptic change. It used to be termed "putrefaction" by the older authors, but that name ought to be restricted to the cases in which putrefactive germs have gained access to the interior of the uterus and set up true putrefaction.

In the first stage of maceration which corresponds with the first 10 or 12 days following intra-uterine death, the external form of the foetus is hardly modified, and the parts retain their firmness. The epidermis here and there (limbs, neck etc.) is raised up into blebs containing blood stained serum; some of these may have burst and their contents passed into the liquor amnii to mix with it, and with the meconium in it. In the body cavities there is found a more or less clear serum, and the organs are somewhat soft; the subcutaneous tissue is infiltrated with serum, and the brain shows some softening, especially in the gray matter.

In the second stage, tenth day to fortieth, the macerative changes have become very marked. At this stage the whole foetus is somewhat swollen, but on account of its softness tends to flatten out on any hard surface upon which it may be laid. The abdomen, in particular, flattens out, as does the head in an antero-posterior direction. The epidermis is absent over nearly the whole surface of the body, leaving the dull red underlying skin fully exposed. On the scalp, however, it is attached. The cranial bones move freely on each other, and the scalp tissues are swollen and infiltrated with serosanguinolent fluid, which may accumulate, especially at the vertex, and produce a spurious caput. Everywhere there is found this sero-sanguinolent fluid in the subcutaneous tissue, between the muscles, in the abdomen, in the thorax; so constant and so copious is it that C. Ruge gave the name hydrops sanguinolentus to the foetus in this stage of maceration, and the name was quite warranted, although it came erroneously to be regarded as equivalent to the syphilitic dead foetus. All the internal organs show softening and the brain is quite diffluent, only maintaining its form by the help of the surrounding membranes. The heart, the liver, the spleen, and the lungs are all more or less altered in shape on account of their softness; they may be pale in colour, or stained to a greater or less degree with blood. Under the microscope the epithelial elements of the tissues can be recognized as swollen and granular or fatty in appearance; the changes in the stroma of the organs are little known and the blood corpuscles may be found swollen and paler in colour than normal, or else shrivelled and broken up into granular masses. The colouring matter of the blood is dissolved in the fluids of the body cavities, or lies as small crystals in the tissues. During the second stage of maceration the histological elements of most of the organs and tissues become unrecognizable. In the third stage, which lasts, according to Lempereur, from the 40th to the 60th days of intra-uterine retention, the cellular elements of even the lungs are unrecognizable. The absence of the epidermis is now complete and is seen even on the hairy scalp; the softening of the body is very marked; the internal organs rest in a collapsed state upon the vertebral column; and the brain is simply an "emulsion of nerve tissue."

Thomsen[16] describes an edema of the scalp and scrotum. The placenta is dull, due to edema, and the cord also has an edema of Wharton's jelly. Microscopically there is an increase of lecithin and a granularity of the cytoplasm which is distinct from the granularity of cloudy swelling, the latter being a process occurring in living cells. The cells later undergo swelling and a loss of the cell outline. The nucleus undergoes caryolysis.

Thomsen further brings out that maceration, similar to other autolytic processes, takes place in an acid medium. Normally the liquor amnii is alkaline or neutral. As maceration advances and the large serosanguinous bullae rupture, they discharge their acid contents into the liquor, thus favoring further autolysis. The state of metabolism also seems to affect maceration, since the more premature the fetus, the more rapid the maceration.

Strachnan[15] emphasizes the point that the bone changes in maceration resemble the chondroepiphysitis of syphilis, and that care should be exercised in using this sign for the diagnosis of fetal syphilis.

Bibliography

1. Ballantyne, J. W. Ante-natal, intra-natal, and neo-natal death; causes, pathology, and prevention with special reference to ante-natal death. *Brit. M. J.*, 1922, ii, 583.
2. Holland, E. L., and Lane-Claypon, J. E. Child life investigations: a clinical and pathological study of 1673 cases of deadbirths and neo-natal deaths. Privy Council, Medical Research Council. Special Report No. 109, 1926.
3. Holland, E. L. Report on the causation of foetal death. Report on Public Health and Medical Subjects No. 7, Ministry of Health. London, 1922.
4. Thomson, C. J. The causation on still-birth and neo-natal death. *J. Obst. & Gynec. Brit. Emp.*, 1926, xxxiii, 390.
5. Holt, L. E., and Babbit, E. C. Institutional mortality of the new-born. *J. Am. M. Ass.*, 1915, lxiv, 287.
6. Cited from Holland and Lane-Claypon.[3]
7. Williams, J. W. The limitations and possibilities of prenatal care. *J. Am. M. Ass.*, 1915, xliv, 95.
8. Williams, J. W. The significance of syphilis in prenatal care and in the causation of foetal death. *Johns Hopkins Hosp. Bull.*, 1920, xxxi, 141.
9. Cruikshank, J. N. Syphilis as a cause of foetal death. *Brit. M. J.*, 1922, ii, 593.
10. Browne, F. J. Neo-natal death. *Brit. M. J.*, 1922. ii, 590.
11. Lyon, E. C. The study of still-births occurring in 4000 consecutive deliveries. *Am. J. Obst. & Gynec.*, 1927, xiv, 548.
12. Holland, E. L. Intra-natal death. *Brit. M. J.*, 1922, ii, 588.
13. McIlroy, A. L. Foetal death due to toxemia. *Brit. M. J.*, 1922, ii, 589.
14. Strachnan, G. I. The pathology of the placenta. *J. Obst. & Gynec. Brit. Emp.*, 1926, xxxiii, 271.
15. Strachnan, G. I. The pathology of foetal maceration. *Brit. M. J.*, 1922, ii, 80.
16. Thomsen, C. J. The pathology of foetal maceration. *J. Obst. & Gynec. Brit. Emp.*, 1927, xxxiv, 40.
17. Ballantyne, J. W. Ante-natal Pathology and Hygiene. London, 1902. Vol. 1, pp. 422–423.

THE PRACTICAL APPLICATION OF LOCAL ANESTHESIA IN MAJOR SURGERY*

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CINCINNATI

So much literature has appeared recently concerning the use of local anesthesia in major surgery, that I think we should try to analyze the various drugs and methods used in the abolition of pain sensation in a chosen region, and attempt to place or limit them, as the case may be, within their respective fields. Dr. R. E. Farr, in a recent article, advised that almost every abdominal operation be performed under local infiltration, while other surgeons restrict its use to a comparatively limited field of minor surgery or in exceptional cases where ether or its combinations are contraindicated.

As in other things, there must be a happy medium, and it is this which I shall attempt to find; I believe that when it is found it will serve a twofold purpose: on the one hand, to the surgeon in overcoming the confusion which now exists in his mind as to which method to choose; on the other, to the patient, in eliminating painful procedures when local anesthesia is not advisable, or unnecessary etherization when general narcosis is not justifiable.

EVOLUTION OF ANESTHESIA

The important steps which made possible local anesthesia as it is employed at the present time were the introduction of cocaine by Koller in 1884; the procedure of infiltrating the tissues with weak anesthetic solutions initiated by Schleich; and the discovery that infiltration of cocaine into or around a nerve trunk in any part of its course effectively blocked the area supplied by that nerve. With these three discoveries it was thought possible that local anesthetics would soon entirely supplant general anesthetics in their application to major surgery.

But we had overlooked other features; insensibility to pain is not the only requisite to be desired, but we must also obtain sufficient muscular relaxation to insure the proper performances of the procedures contemplated; and not alone this, but it was soon discovered that not every operator possessed the necessary experience and skill in the use of local anesthetics. In other words, surgeons who had become accustomed to working on the anesthetized patient could not readily adapt themselves to the delicate technique and patience required in the successful performance of surgery under local narcosis.

The difficulties encountered have led many surgeons to discard local anesthesia almost entirely and continue with the use of general narcosis in almost every case. With the coming of younger surgeons, however, especially trained in its use, local anesthesia has been given a renewed impetus. Indeed, it is safe to say that fully 50 per cent of all operations performed at the present time under general narcosis could be satisfactorily performed under local anesthesia intelligently used. Whether or not this is to be desired, I shall try to show presently.

METHODS AND DRUGS EMPLOYED FOR LOCAL ANESTHESIA

At the present time two methods of producing local anesthesia are generally used: (1) agents which freeze the tissue and (2) chemical analgesics such as cocaine and its substitutes.

We shall not consider the first, of which

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ethyl chloride is a type. Of the second, cocaine, novocaine (procaine), apothesine, stovaine, and quinine and urea, are those most commonly used. Of these, novocaine holds the most important place and has stood the test of time. The repeated comparing of the toxicity of novocaine with that of apothesine, stovaine, etc., may lead the physician to believe that they all have the same anesthetic potency in solution of equal strength. We have used nothing but novocaine during the past eight years and have yet to see a case of poisoning or even idiosyncrasy. It is true that an idiosyncrasy may exist, but this would apply equally to all local anesthetics. The toxicity of apothesine has been rated to be twice that of procaine by the Council of Pharmacy and Chemistry of the American Medical Association.

The combination of quinine and urea was introduced into surgery in 1907. It has several advantages, having no toxic effects as far as is known and producing an anesthesia which lasts from twenty-four hours to four or five days. At the present time the drug is employed in 0.5 to 0.25 per cent solutions. In stronger solutions it has been known to interfere with wound healing.

To sum up, therefore, the clinical dangers cannot be predicted by the use of any one drug, since clinical accidents depend upon idiocyncrasies, or the technique of application. Novocaine 0.5 per cent with 8 drops of adrenalin solution 1:1000 is still our choice.

SUITABLE CASES FOR LOCAL ANESTHESIA

To what extent can local anesthesia be successfully and satisfactorily employed? Many authors and surgeons differ on this question, and therefore we shall try to give a presentation of our own experience.

For the minor procedures, such as exploratory puncture, amputating toes or fingers, circumcision, removal of benign growths such as wens, cysts, lipomata, benign tumors of the breast, or isolated superficial glands, we use local anesthesia entirely, with two exceptions: we never use local anesthesia in inflammatory tissues, and never in cancerous tissues, not only because we cannot induce satisfactory anesthesia in inflamed tissues, but also because we are liable to disseminate the infection or cancer to other parts.

For the greater amount of major work we have become rather skeptical of the efficacy of local anesthesia, after giving it a thorough trial.

During a period of four years I have personally performed over one thousand major procedures under local infiltration, including thyroidectomies, herniotomies (inguinal and femoral), appendectomies (interval and acute), suprapubic cystotomies, rib resections, amputations (Biers' method), cholecystostomies, supravaginal hysterectomies and abdominal explorations. During this period, I tried to preserve an open mind toward anesthesia in order not to prejudice myself with either, and if anything I think I rather leaned toward the local method because I was anxious to see to what extent it could be used.

The result is that I now limit local anesthesia as a routine measure to one major procedure, namely, herniotomy. Local anesthesia is ideal in herniotomy because of the superficial location of the structures involved and the definite position of the sensory nerve trunks supplying the field of operation. I formerly used local anesthesia in all thyroidectomies, but found that even though we had perfect anesthesia, still the patients complained a great deal of strangling as the lobes were being elevated. Occasionally, unless they were deeply narcotized, they became panicky at this stage. While this was the exception, it was a very disagreeable one.

Herniotomies and thyroidectomies were, however, on the whole successful in my hands. By successful I mean that they can be performed thoroughly and painlessly under local infiltration.

From this you would infer that the other operations were not successful. This was

not entirely true. Many of these patients did not complain of any pain, although some did. In others we did not get good relaxation; we could not maintain good exposure because of resistance on the part of the patient. This was especially true in operations upon the upper abdomen and existed from the very beginning of the procedure; whenever a walling-off pad had to be used, there was always the sickening sensation of pulling on the intestines; the interval appendectomies were painless but the readjustment of the bands and membranes, when encountered, was not satisfactory. Inflammatory cases were never satisfactory, for reasons already stated.

For strangulated hernia of any variety, local anesthesia should always be the method of choice. The added strain of general anesthesia upon these patients, already toxic, is frequently more than they can withstand, and there is no need for haste as an abundance of time can be taken to restore the gut of doubtful vitality.

For the majority of abdominal operations, therefore, I would say that local anesthesia is not satisfactory, not because there is any difficulty in entering the abdominal cavity, as this can be very readily done, but because of the various complications that may be present. We know that the abdominal organs are insensible to pain, but the parietal peritoneum is most sensitive, especially when inflamed; and as has been shown, any breaking of adhesions or dragging upon the mesentery is likewise painful. Furthermore, complete relaxation is necessary in abdominal surgery to secure the necessary wide exposure, and this cannot always be obtained under local anesthesia.

Operations about the scrotum, as for varicocele or hydrocele, are all amenable to local anesthesia, as are also many operations about the rectum, such as fissure or thrombotic hemorrhoids. However, when thorough stretching of the sphincter ani is essential, then general narcosis is preferable.

In addition local anesthesia is contraindicated in children or those greatly excited or hysterical.

ADVANTAGES AND DISADVANTAGES OF LOCAL ANESTHESIA

It must be remembered that I have been using only infiltration methods in recording my above experiences. I have used intraspinal anesthesia in probably fifty instances but always on bad risk cases, such as diabetic or senile amputations, prostatectomies, etc., and have had some gratifying experiences. However, in a number of instances it was necessary to supplement nitrous oxide. While it is my belief and hope that methods will be developed whereby the average surgeon may use intraspinal anesthesia with safety, at present I am skeptical.

Dr. McClintic, in his paper, has claimed that the infiltration method distorts the structures, lowers tissue resistance, distorts chemical equilibrium and slows the process of repair. This has not been our experience. We have certainly performed over 2000 operations with local infiltration at our clinic, and in every instance healing has been commensurate with healing under general narcosis. In fact, I believe that because of the more careful handling of tissues under local anesthesia the healing is cleaner and more rapid.

An argument often brought forward in the presentation of the merits of regional anesthesia is that this method requires the use of less solution than does the infiltration method, with attending decrease in danger from absorption. It is questionable whether this is so. It is not necessary in infiltration to water-log the tissues; and even though a great deal of solution is used, a large part of it runs out through the incision which is made in the edematous tissues, while in the regional method all is absorbed.

I therefore feel that regional anesthesia still has an active competitor in the more practical method of general infiltration. Direct infiltration possesses the advantages of simplicity and speed. It has always

seemed to me that paravertebral or parasacral anesthesia is a major operation in itself and is not always without discomfort to the patient. It is true that in the hands of the expert, regional anesthesia has a wider application; but can it be compared in application or safety to a smooth general anesthetic given by a competently trained anesthetist?

Local anesthesia unquestionably has many advantages over general narcosis, especially in thyroidectomies and herniotomies. In the former the postoperative blood changes and the kidney, heart and lung complications are all avoided. Likewise in goiter, the danger of secondary hemorrhage from vomiting is greatly lessened and the patient may be allowed to drink immediately after or even during the operation, thereby allowing a free flushing of the excretory system.

In hernia also there is a distinct advantage in having the patient conscious, that he may demonstrate the protusion by coughing. There is also less danger of the forcing or breaking of sutures and tearing of tissues from postoperative vomiting, thereby favoring a recurrence of the rupture.

I cannot see where local anesthesia has any advantages over general anesthesia in the remainder of major surgery, with the possible exception of poor risks. I do not believe that it lessens postoperative pneumonia, which in my experience occurs in drainage cases where, for some reason or other, drainage has become impaired and is of embolic origin. That it lessens mortality is not appreciable. In my opinion the advantages of general anesthesia overbalance the advantages of local anesthesia in major surgery, with the exception of the two procedures mentioned.

THE PREPARATION OF THE PATIENT

The preparation of these patients is important from a psychic viewpoint as well as the physical, and the success or failure of the operation frequently depends upon the preparation up to the time of operation. Nerve calm can usually be assured by prevention of apprehension on the part of the patient and can be brought about by a good night's sleep before the operation and by reassurance from the nurse in charge. Morphine grain $\frac{1}{4}$ is given one-half hour before the operation, unless contraindicated. This serves to allay the nervousness on the part of the patient and is also the physiological antidote of cocaine.

In goiter cases where we have an exaggerated type of nervousness, we usually precede the operation with morphine grain $\frac{1}{6}$ and hyoscin grain $\frac{1}{200}$. In doing over 100 consecutive thyroidectomies by this method we never had to resort to general anesthesia.

THE CONDUCT OF THE OPERATION

There are three things which are quite essential to the successful conduction of an operation under local anesthesia: (1) an intelligent appreciation of its limitations; (2) experience and skill on the part of the operator; (3) knowledge of the sensory nerve supply to the given region.

To attempt to operate any or every case under local anesthesia is but to court failure. A nervous, fidgety operator will never find encouragement in local anesthesia. Cocaine surgery requires a patience and a technique entirely foreign to that of general anesthesia surgery.

The patient should be made as comfortable as possible upon the operating table. The operating room should be kept as quiet as possible, and especially does this apply to the handling of the instruments. Clean-cut dissection should be the rule. Rough manipulation, pulling or tearing of tissues is never permissible. Not infrequently, carelessness in observing the slightest details early in the operation causes restlessness and apprehension on the part of the patient, or even complete demoralization to the point of causing the operation to be discontinued until a general anesthetic has been given.

"Failure" with local anesthetics and condemnation of the method oftentimes results

from neglect in observing these small and apparently trivial details.

SUMMARY

1. Novocaine in weak dilution is still the most efficacious and most reliable drug for use in local anesthesia.

2. I would recommend local anesthesia in all inguinal herniotomies and bad risk thyroidectomies, aside from minor procedures, because in these two procedures local anesthesia has distinct advantages. It is true that with intelligent and skillful use of local anesthesia by one expert in its technique, a great many more major operations can be successfully performed. Furthermore, it must not be forgotten that local anesthesia in a major operation can be used up to the painful part and then nitrous oxide or a small quantity of ether may be given to tide the patient over the painful procedure, a method which is now known as combined anesthesia or anocithesia.

3. Local infiltration is never permissible in infected or cancerous tissues because of the danger of disseminating the infection or cancerous lesion.

4. As with other methods of anesthesia, local anesthesia has its indications and contraindications, its possibilities and its limitations. As has been said, it is especially valuable in thyroidectomies and herniotomies. For other major operations it does not always remove all painful and other disagreeable sensations and it makes demands on the surgeon's time, patience and technique, that all operators are not willing to allow; and only certain patients have the desire or fortitude to remain aware while their operation is in progress.

At one time Matas observed, "It is this tax upon the operator's attention and the vigilance required to keep the inhibitory powers of the patient under control, and the time consumed in the anesthetizing procedure that will prevent cocaine and the local analgesics from gaining ascendency in the crowded amphitheatres of popular teachers where quick and brilliant work is expected by an impatient audience."

SURGICAL ASPECTS OF MEDICAL CONDITIONS*

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NEW YORK

"WHENEVER one studies, even superficially, any generation of men who have acted in the past and of whose actions there is some considerable record, that I think which most strikes the curious student is the nature of the things which were taken for granted during the period."

If we were able to achieve an entirely adequate philosophical detachment, we might be struck with the same wonder in contemplating our own time. However, this is impossible. We are too much a part of it, too much afflicted ourselves with its prejudices and preoccupations to extricate ourselves, save in part.

I do not intend to bore you with more than a suggestion that no doubt other men will marvel at us and the things we take for granted, as we ourselves marvel at the forgotten fashions of a few years ago. Surely if this is true in any field of human thought and activity it is true in medicine.

It would be interesting to catalogue some of the things we take for granted in medicine today. There are a number of them, but this would lead us away from our subject, and I only venture to suggest one: the distinction between medicine and surgery. It is unreasonable; no one really likes it. One would like to be able to say, like Sir Berkeley Moynihan, "I am a physician practicing surgery," but the distinction does exist, and in spite of the growth of many regional specialties, so-called, which profess to cover both the medical and surgical care of certain groups of organs, the physician and the surgeon, whether in general or in special practice, must work together if the patient is to be well served.

I am going to try to discuss rather briefly a few groups of conditions, chosen because they seem to me to typify surgical hazards that arise on the medical side. May I say that I approach this subject with diffidence, not to say trepidation, knowing very well how often the surgical patient needs and craves the kindly skill and wise judgment of the physician and how seldom one hears from the medical ward the cry "Get me a surgeon."

However, I wish to offer for your consideration a group of conditions in which surgery becomes more or less necessary and in which varying factors influence the decision as to the time for operative effort.

I should like to discuss the following groups, not with the idea of covering this large field, which is manifestly impossible in the short time at our disposal, but rather to sketch the outlines of a system of cooperation between physician and surgeon.

SURGICAL ASPECTS OF MEDICAL CONDITIONS

The immediate emergency.
The place of surgical diagnosis.
The timeliness of surgery.
Surgical treatment of symptoms.
The surgical complication.
Surgery in certain toxic states.
The surgical handicap.

THE IMMEDIATE EMERGENCY

The field of activity of the surgeon in medical conditions may be said to consist, first, in those cases in which an emergency arises which demands mechanical intervention—a condition in the natural development of the disease which if allowed to go on uninterrupted will terminate in death or in permanent disability. It is in such conditions as these that vigilance and promptness are most necessary.

*This lecture was delivered on February 25, 1927, N. Y. Academy of Medicine.

The immediate surgical emergency comprises:

Hemorrhage.
Embolism and thrombosis.
Spreading infection.
Effusion of fluid under pressure.

Hemorrhage. First of all we will consider hemorrhage, which is always a surgical complication if it be within reach. If it is a superficial hemorrhage, its control, as a rule, will be easy, unless it so happens that it is complicated by one of those conditions which interfere with the normal coagulation of the blood.

The methods for the control of hemorrhage need not be discussed here, nor need we linger long over the subject of concealed hemorrhage.

In intracranial hemorrhage we may exclude the traumatic cases because they are frankly surgical, and at present ignore the intracerebral apoplexies as being seldom surgical. A small number of cases of cortical hemorrhages due to pachymeningitis may be recognized and occasionally dealt with.

Hemorrhage within the gastrointestinal tract is one of the problems with which the physician has to deal.

Hemorrhage from gastric ulcer, suspected hemorrhage from cancer of the bowel, massive hematemesis—when should they be turned over to the surgeon, and how should the hemorrhage be dealt with? As a rule, this condition is not an emergency, but only a sudden revelation of the condition which is its cause. The patient should be kept at rest until the hemorrhage ceases, after which transfusion and other means should be used to restore him to a condition in which surgical diagnosis may be attempted.

Just a word about transfusion. The fact that this very useful procedure has been unfortunately abused is no reason why it should not be properly called into service when necessary, and nowhere will it be more useful than in case of hemorrhage. It is a procedure to be considered very definitely, from the point of view of both the physician and the surgeon. It is most important that the donor's blood should be sound and that it should match that of the recipient. It is, of course, a transplantation of tissue, and if improperly done may do more harm than good.

Embolism and Thrombosis. In regard to embolism and thrombosis, there are two points in which surgery may be very useful. Embolism occasionally occurs in the peripheral arteries; and in the few cases where the surgeon has proper time, which will be only within a few hours, and where the unfortunate embolism is not repeated, very good results are obtained by cutting down on the artery and removing the clot. Unfortunately, however, embolisms are usually multiple.

In the thrombosis which occurs in certain infections involving the extremities, there can be no doubt that ligature of the veins involved on the proximal side of the thrombosis is a most important procedure in preventing pyemia. We are familiar with its use in ligation of the internal jugular in cases of lateral sinus thrombosis, and the same procedure might, I believe, be made use of more often in other infections.

Spreading Infection. Spreading infection is, I think, sometimes considered too much of a surgical emergency, because we have, all of us, a sort of superstitious feeling that the knife is good for infection as such. I have heard a famous surgeon speak of the antiphlogistic touch of the knife. There is no such thing. The mere use of the knife simply adds trauma to the patient's burden. The knife is used to free fluid under pressure, or to remove a spreading process, such as gangrene, which can be stayed in no other way. So, one removes a gangrenous extremity or a gangrenous appendix, and, so, one incises an abscess which is causing pressure necrosis. But to incise a spreading cellulitis, which we see so often done, is simply to fan the flame.

The neglected appendicitis goes on to peritonitis all too rapidly; and when it is too late, the physician is quite prepared both to recognize and to call for surgical

interference in most of these acute conditions. In most, but not in all.

May I draw attention to one condition which has as yet in great part escaped the notice of the practitioner and which I believe would greatly benefit by further study? I allude to the acute or subacute hydrocephalus associated with the infections of the meninges, and I am venturing to discuss this condition briefly because it is a type and a very perfect one, it seems to me, of that group of conditions in which fluid under pressure demands immediate relief. This fact the physician has recognized better than the surgeon in dealing with, or rather, in attempting to deal with this condition. He has attempted to relieve the increased intracranial pressure by repeated lumbar puncture and even by cistern puncture, realizing well enough the extremely short period of relief thus obtained, but having nothing better to offer. The surgeon, on the other hand, in dealing with meningitis has been obsessed with the idea of drainage for infection, a notion which in less than a hundred years will be found to have had as much mysticism in it as the blood-letting of our ancestors. Drainage (subtemporal, suboccipital) above or below the tentorium while the fluid is accumulating in the ventricles increases its pressure unrelieved.

Fluid under Pressure.

1. Acute hydrocephalus.
2. Fluid in the chest.
   a. In the pericardium.
   b. In the pleura.
3. Fluid in the abdomen.
4. Urinary pressure.
5. Acute hydrocele.

I cannot discuss the subject of fluid under pressure more fully at this time, and merely draw attention to it in passing. In the presence of fluid under pressure, two things are necessary: recognition and relief.

The presence of intraventricular pressure is to be suspected in any case of meningitis showing signs of increased intracranial tension, headache, vomiting, choked disk, etc., recognized by the manometer reading of the spinal pressure, which, by the way, cannot be guessed at with any degree of success, and finally determined by the injection of a little air (30 to 50 c.c.) into the spinal canal and a roentgen-ray exposure in two planes. It is not necessary to exhaust the spinal fluid; the injected air will show the degree of dilatation of the ventricle and the presence or absence of brain-stem block. If this is present, a section of the corpus callosum is indicated. This will convert an internal hydrocephalus into an external one. It will immediately relieve the subtentorial pressure. It will furnish access to the arachnoid channels of absorption over the hemispheres, which will be more or less permanent. It is readily and quickly accomplished. The skull is trephined 2 cm. from the midline along the right parietofrontal suture. The dura is nicked and a needle introduced into the ventricle. When the tension has been thus reduced, the dura is opened and a flat silver spatula, 1 cm. in width, is shaped so as to pass over the mesial edge of the hemisphere and along the surface of the falx down to the corpus callosum. It is then thrust through this structure into the dilated ventricle. A gush of fluid follows; the flat probe is gently moved so as to assure a 2 cm. section and withdrawn. The dura is closed. The trephine button is replaced and the scalp carefully closed in layers.

I know of no other operation which attempts to fulfill the indications in these cases.

In acute hydrocephalus, the diagnosis is made by lumbar puncture with manometric reading, and by encephalography.

Inject 25 to 50 c.c. of air into the spinal canal after withdrawing an equal amount of fluid.

Roentgenography also aids in diagnosis.

Acute internal hydrocephalus in meningitis is due to arachnoid block, is a common cause of death, may occur very early in the disease, and is relievable by: lumbar puncture; ventricular tap, which gives

temporary relief for a few hours; and corpus callosum section, which gives permanent relief.

THE PLACE OF SURGICAL DIAGNOSIS

A word as to the place of surgical diagnosis. I said that the distinction between surgery and medicine is sometimes a curious thing, yet very necessary and very real, and nowhere is the distinction between surgery and medicine more illogical than in the distinction between medical and surgical diagnosis, yet nowhere is this more real; for the method by which the physician approaches his problems and the angle at which the surgeon attacks his are not the same. The physician imagines a scientific problem which he approaches in a properly scientific attitude of doubt. His mind is open and his eyes perhaps are shut. He proceeds to reason. He makes his solution as far as possible by exclusion, so that his logic may be secure and that he may feel that his findings on paper are irrefutable. But the surgeon has a different sort of method. He has to meet in daily life the sort of things which do not permit the physician's method of approach. For instance, a patient comes into his office uttering the characteristic sounds of one who has a cleft palate, and the surgeon immediately suspects a cleft palate. He says to the patient, "Open your mouth," and examines and finds a cleft palate. This is a simple instance. The surgeon's mind proceeds from suspicion to an immediate attempt to verify or disprove. He is obliged to fall back on direct methods of examination with instruments capable of inflicting trauma, and not the least of these is the hand. How often the patient says, "Your fingers are like steel," no matter how careful you try to be. The fingers may do harm, but not so much harm as the other instruments which are at the surgeon's disposal and which he finds himself frequently obliged to use. Even a roentgen-ray examination, if one is incautious, may do harm. Not so long ago a woman came to my office, who had had 126 roentgen-ray exposures of the abdomen in an attempt to verify suspicions and find out her trouble. She had begun to show the effect of these exposures even upon her skin, and while no indications were evident of any internal damage having been done, I have no doubt that she had sustained it.

By surgical diagnosis is here meant direct methods of physical examination with instruments capable of inflicting trauma.

Such are:

All roentgen-ray examinations.
All endoscopies.
Aspirations.
Diagnostic removals of tissue.
Exploratory sections, to be properly used only when:
(*a*) No harm is done.
(*b*) Some good is accomplished.

In cases of suspected intestinal obstruction, the administration of a barium meal has in more than one instance precipitated a condition which might perhaps have been avoided. Such cases, if examined by the roentgen-ray at all, should be dealt with only by enema.

All endoscopies may be considered dangerous in certain acute conditions. Acute colitis does not do so well under a sigmoidoscopy. We have all seen cases of harm resulting from cystoscopy and from unwise pyelography.

The diagnostic removal of tissue is a procedure not without danger. It is so simple to curette and remove a piece of tissue to see if it be cancerous, and yet this investigation may be enough to disseminate the growth and by this very act place it beyond the reach of proper surgical care.

THE TIMELINESS OF SURGERY

We have seen how important is prompt recognition and intervention in the group of conditions of which I have ventured to submit a somewhat typical instance. There is, however, another aspect of this group of conditions, and it may be stated as a principle that while diagnosis should be

made as early as possible, it should be made by measures which do not in themselves do the patient harm, and surgical intervention should be accomplished at the proper time. To hasten this unwisely is as unfortunate as to delay it foolishly.

SURGICAL TREATMENT OF SYMPTOMS

This may seem to be merely a platitude to some of you; but allow me to discuss rather briefly a common condition and its more or less standardized management, in which I think you will agree with me

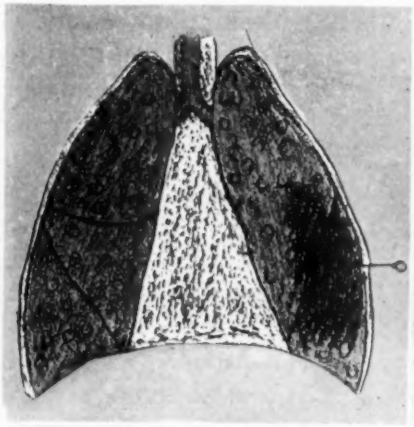
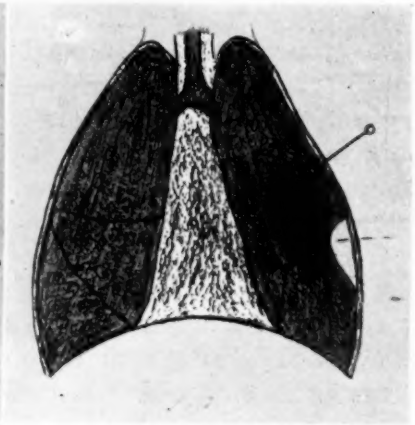


Fig. 1.



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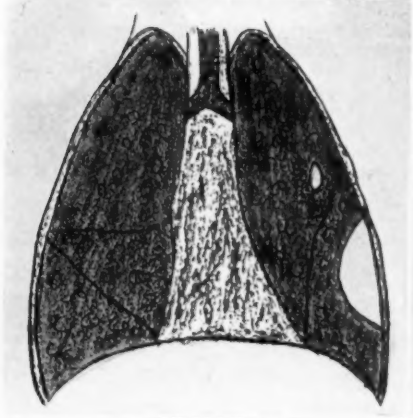

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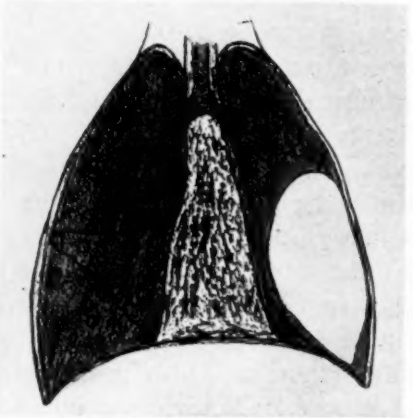

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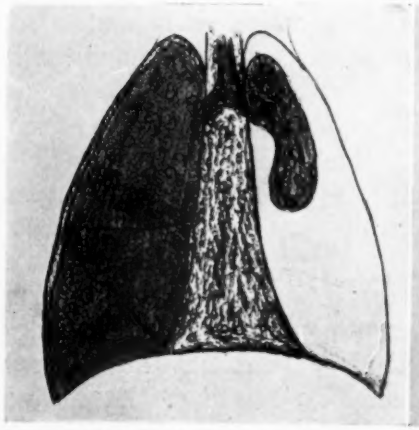

Fig. 5.

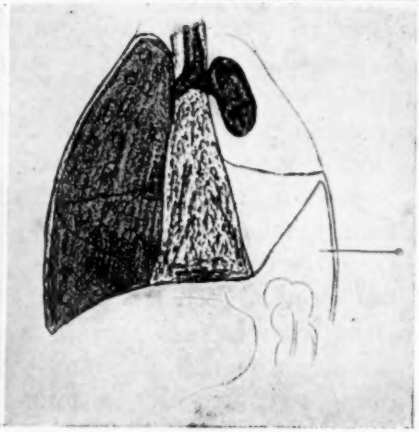

Fig. 6.

Fig. 1. Punctured wound of the lung by paracentesis needle.
Fig. 2. Small sacculated empyema as result of stab wound of infected lung; another stab higher up.
Fig. 3. Sacculated empyema, small abscess of lung resulting from stab wounds.
Fig. 4. Sacculated empyema increasing in size at the expense of the adherent lung.
Fig. 5. Free pleural empyema.
Fig. 6. Pyopneumothorax showing ascent of the diaphragm on the left side.

that both these principles are regularly violated. I refer to the diagnosis and treatment of empyema, particularly the metapneumonic empyema of childhood. In the course of or following a pneumonia, sometimes after a subsidence of fever and an apparently well-begun recovery and sometimes in the course of an unduly prolonged and unsatisfactorily protracted illness, physical signs in the chest, such as flatness and absent breathing, lead the physician to suspect the presence of pus within the chest. He considers his duty plain and proceeds to aspirate the chest.

Let us suppose that he finds pus at the first tap. The next move is plain. Get a surgeon and have a rib resected and the empyema drained. Too often this is done with no consideration of the stage of the disease or the condition of the patient, no question as to whether the lung be fixed or not, no question as to the condition of the other lung. The disease must be treated. The pus must be evacuated and the little patient must take his chance.

But perhaps the child is more fortunate and at the first aspiration no pus is found—a dry tap. How soon and how often will it be repeated? At short intervals, every few days, until at last the repeated stab wounds of infected lung and pleura bring their reward and an empyema has been proved.

How many cases of empyema would never have occurred if these cases of irregularly resolving pneumonia had not been subjected to needling? It is impossible to say, but I am persuaded that a weekly roentgenographic study of such cases would not only diminish the mortality, but would cut the morbidity in two.

Nor does the use of the hollow needle end here. In one of the army camps I found 20 fatal cases of peritonitis in something over 200 cases of empyema, most of which were treated by repeated aspiration. In a study made with Cole we found that after aspiration the diaphragm on the left side not infrequently reached the level of the fourth rib.

When one remembers that a stab wound through an infected pleura and the left leaf of the diaphragm would reach the lesser sac and when one reflects at the same time how obscure the signs of such a peritonitis often are, one wonders how often this complication exists in civil practice.

There are occasions when a large effusion in the pleura embarrasses the respiration or the heart, and a thoracentesis should be done—once; I doubt the wisdom of its repetition. Certainly the chest should not be drained until the lung has had time to become adherent, until the other lung is clear and until the patient's nutrition and fluid balance are as well cared for as may be.

I have discussed the surgical aspect of this complication of pneumonia because I think it is a rather typical example of some errors into which we easily fall with many somewhat similar conditions:

First, a diagnostic procedure which is not innocent; second, a failure to appreciate the importance of selecting the proper time for surgery; and third, the grave danger of standardizing a surgical treatment for a disease rather than adapting treatment to the patient.

THE SURGICAL COMPLICATIONS

This may be (1) an exacerbation of an underlying handicap or (2) an accidental invasion from without, as in diabetes, infection leading readily to gangrene.

In this connection the relation of surgery to diabetes may be selected as an example.

The diabetic patient has a 20 to 25 per cent chance of dying of a surgical complication of his disease. This liability is greatest in the sixth decade. Fifty-two per cent of all cases occurred in that period in the series of Eliason and Wright. The cases of surgical deaths were: septic and gangrenous legs, 36; carbuncles, 9; acute appendicitis, 4.

The fact that diabetics are notoriously bad surgical risks entitles them to most careful preventive measures. They should be warned against all apparently slight

forms of infection, and these should be promptly attended to when they arise.

The fact that they are so vulnerable to infection should exempt them, if one may so phrase it, from all operations except those of necessity; and when a patient presents himself with diabetes and an inevitable operative condition, he must be treated as if he were, as Foster has said, a candidate for coma.

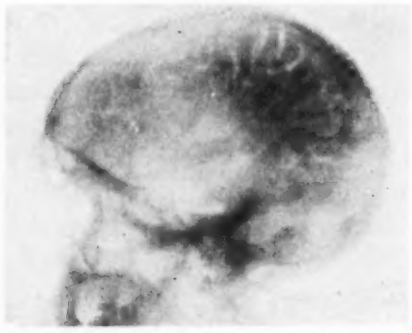

Fig. 7. Encephalography showing arachnoid space outlined in air.

The details of the medical treatment may well be left with the physician, who will do everything in his power to forestall acidosis.

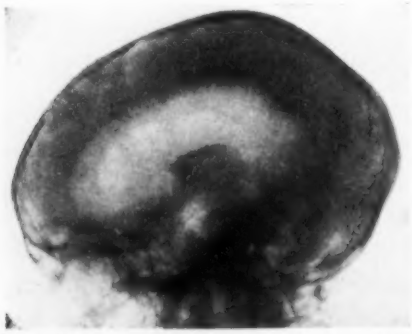

Fig. 8. Encephalography, internal hydrocephalus with obliteration of the arachnoid spaces over convexes.

SURGERY IN CERTAIN TOXIC STATES

In the presence of infection in gangrene, surgery should not be delayed, and spinal anesthesia should be used whenever possible. In situations where this is not possible, nitrous oxid and oxygen in skilled hands is better than ether.

Gangrene occurs in two forms: the dry gangrene of one or more toes, and the moist, septic gangrene spreading up the foot and leg.

In older patients in whom arteriosclerosis overshadows the diabetes, the dry gangrene may be treated by conservative amputation through the lines of demarcation.

In the moist variety the amputation should be immediate, through the lower third of the thigh. Since the development of anti-gangrene sera in the late war, French surgeons have made use of this procedure in diabetic gangrene. We have followed this precedent in using the only American serum available, which has been useful in our hands.

Fig. 9. Corpus callosum section, author's method.

In a small series of cases (6 or 7) we studied the gangrenous tissues removed at operation and found them filled with the Welch bacillus. In several cases high amputations, done with scrupulous precautions, of course, gave a gas infection of the stump. These were controlled promptly by the use of the serum; and its subsequent use in a few cases has been followed by limitation of the spread of a moist gangrene at the base of the toes. I believe it is a useful adjunct, but one which should not be used as a substitute for surgery.

As an additional factor in the after-care of the diabetic, as, in fact, in all elderly patients, exercise in bed is recommended. In order to be useful, this should be regular, vigorous and amusing. Making motions is a bore. I can recommend the use of a string of toy balloons above the patient's bed within reach of his hands and feet. Once an

hour, on the hour, he will rise on his pillow and smite these toys with a will, with an effect on his blood pressure and blood sugar that no calisthenics can equal.

There is another relation which surgery and diabetes may bear to each other. I allude to the connection of pancreatitis and diabetes. Vischer reports 5 cases of glycosuria apparently secondary to abdominal and rectal infections. These improved following surgical operations, which suggests the importance of such a relation. Rabinovitch analyzed the statistics of the Montreal General Hospital and concluded that nine times as many patients had both cholecystitis and diabetes as would be expected if the diseases were completely independent of one another.

THE SURGICAL HANDICAP

This may consist of a chronic medical disease and a surgical condition which aggravates the trouble, such as:

Diabetic patients....	Cholecystitis
Cardiac patients.....	Hyperthyroidism
Tubercular patients..	Adhesive pleurisy
Chronic dyspepsia...	Gastrointestinal deformity and infection

I have implied more than once in what I have said that the patient does not benefit by a misunderstanding between medicine and surgery. Nowhere is this more clearly seen than in the too unfortunate fate of the chronic dyspeptic.

If any sick man deserves a scrupulous and intensive study it is he. How often does he get it? More than this he needs, however, a wise judgment based on the results of the examination and an intelligent program with or without surgery.

The dyspeptic comes on, is brought to the surgeon, after having had, as a rule, a good deal of treatment and more or less diagnostic study. It is comparatively rare for him to have had a true abdominal survey. In fact, unless he is a poor man and has had the good fortune to go to a good clinic, he will hardly find the mechanism for making one. He is much more likely to wander from one specialist to another until he falls into the hands of haphazard surgery.

It seems as if a more logical procedure might be expected. There is no more grateful patient than the cured gastrointestinal invalid, even if this cure was accomplished after many other operations by dilatation of a stricture of the ureter. Nor is there any sadder sight in surgery than the cancer of the stomach, rapidly growing and invading other organs, which might have been recognized one, two or five years before as a deeply penetrating ulcer.

We do not know the cause of gastric or of duodenal ulceration. It would seem as if so consistent a disease might very likely be due to one exciting cause. Perhaps it is; we do not know. We do know that many ulcers heal and patients recover, some with surgery and some without; that many of these cures are only temporary and that recurrences are not uncommon even after surgery. It would seem, however, that a more or less consistent program could be arranged and the gastrointestinal tract treated as a whole.

There are foci of infection in the mouth, about the pylorus, about the ileocecal junction, and occasionally in the sigmoid and anus. These are all susceptible to surgical treatment and should be considered from above downward. In short, the alimentary tract should be cleaned up just as we do, or attempt to do, with the genital or the urinary.

There is a group of patients, particularly the younger ones, who recover and stay well on medical treatment alone. This group will be increased if infected tonsils, teeth, and sinuses are attended to during or after the medical cure.

A second group showing recurrences after this treatment will show, on exploration, more or less chronic infection of the terminal ileum, cecum, and appendix, as well as of the gall bladder, the duodenum, and the pancreas. It is in such a group of patients that by removal of the chronically

infected gall bladder and as much of the ileo colic angle as is irreparably damaged the constant stream of re-infection will be interrupted. The liver freed from its load of poison, the duodenitis and the pancreatitis will heal. It is in such patients as this that an incipient pancreatic diabetes may sometimes be detected and apparently aborted.

Is it too much to say that a patient suffering from chronic digestive disturbances should have the benefit of both medical and surgical diagnosis?

He should have a full and careful study made of his history; a thorough physical examination; his heart and lungs ad genitourinary tract and nervous system not mentioned in passing, but examined and assessed; a proper laboratory examination of the blood and of the urine; and a genuine roentgenographic study. This is only the method; it must be applied by a man of knowledge and skill, for a diagnosis is, after all, an opinion and requires a mind for its conception. One sees extrauterine conceptions; one cannot conceive an extra-mental diagnosis.

A story is told of Thoreau, who was interested at the time in Indian arrowheads and had his pockets full of them. One of his friends (I think it is Emerson who tells it) walking with him in the woods, said, "Where do you find so many arrowheads, Henry?" and Thoreau stooped, picked one up, and said with a smile, "I find them everywhere."

It is the fault of surgical diagnosis of the abdomen to find too easily. The fault of the medicineman we must leave to his conscience and his wit.

SUMMARY OF THE SURGICAL HANDICAP

The chronic medical case deserves:

1. A general surgical survey, done in such a way and at such times as to do no harm.
2. Such special diagnostic measures as the type of case may need.
3. Decision on the facts found as to whether surgery is or is not needed.
4. If surgery is decided on, it is to be very definitely carried on as an incident in the medical care of the case.

THE PATHOLOGY AND PATHOGENESIS OF LEGG-CALVÉ-PERTHES' DISEASE*

(OSTEOCHONDRITIS JUVENILIS DEFORMANS COXAE)

A. PHILIP ZEMANSKY, JR., M.D.

NEW YORK

THE disease which is known today as osteochondritis juvenilis deformans coxae was given its name by Perthes in 1910, shortly after Legg as well as Calvé had each independently described the same condition. It was from the work of these three observers that the clinical and roentgenological aspects of this disease became clear, and were soon recognized everywhere. That all three observers assigned various names, and attributed different natures and causes to this disease does not alter the fact that their clinical and roentgenological descriptions tallied perfectly. Everyone now agrees as to what is meant by Legg-Calvé-Perthes' disease, and the diagnosis can be made with perfect assurance wherever roentgen ray equipment is to be found.

Until quite recently, however, a different situation existed as far as the pathology and pathogenesis of this disease are concerned. The pathological picture was far from clear and the theories of its causation were nearly as numerous as the authors who have written on the subject. Long before this disease was split off from a heterogeneous group of hip-joint affections and became recognized as a separate clinical entity, pathologists had examined heads of the femur from operative or autopsy material from a great variety of cases, and published their findings under a host of titles (malum coxae infantilis, arthritis deformans juvenilis, etc.).

No two names were alike, and the confusion resulting therefrom made the classification of diseases of the hip joint on a pathological basis impossible. There is no question but that some of the cases thus described must have been what we would call today Legg-Calvé-Perthes' disease (or let us abbreviate this to Perthes' disease, for the sake of convenience). A good many, of course, were not. After Perthes' description of the pathology of this condition, in 1913, from a small specimen removed at operation in a typical case, a host of papers appeared on the pathology of Perthes' disease, practically all of them in German, and all of them having some similarity with, and some differences from, Perthes' original description. From our knowledge today of what constitutes the pathological picture of this disease, it is obvious that many different conditions have been described under this title. A great many cases however, (those of Pommers, Frangenheim, Borchard, Erdberg, Kreuter, Negroni, Zesas, and others), can neither be wholeheartedly accepted as Perthes' disease nor entirely dismissed as being something totally different. It may be that these cases are primarily some other condition and have later developed changes similar to Perthes' disease, or vice versa. That this is not impossible I shall try to show later.

Until quite recently, therefore, anyone attempting to collect from the literature all instances of pathological examinations of the head of the femur in cases of Perthes' disease, was confronted with a double problem. First he must pick out those cases which were really Perthes' disease, from reports published under some other title, and second, he must eliminate those cases which were not Perthes' disease from

* From the Laboratories of the Mount Sinai Hospital, New York City. Read before the Orthopedic Section of the New York Academy of Medicine on October 21, 1927.

reports published under that title. Without fairly clear pathological criteria this would seem to be impossible. And yet, as I have mentioned before, such criteria did not lie before us.

In the last few years, however, agreement among authorities on two important controversial points has rendered this selection possible. One is, as Perthes has always insisted, that this condition, while destroying the epiphisis, leaves the joint cartilage intact. The other is that Perthes' and Köhler's disease of the fourth metatarsal are identical. From the masterly work of Axhausen the latter disease has been shown to have a definite and characteristic pathological picture, the most outstanding characteristic of which is massive subchondral bone and marrow necrosis. Therefore, with the criteria of normal cartilage and subchondral necrosis, one is equipped partially with the instruments necessary to choose from the wealth of published observations those cases which can be properly called Perthes' disease. The recent papers of Walter, Konjetzny and Rockemer have also helped to establish these criteria as the ones essential for a pathological diagnosis of Perthes' disease.

Before these criteria were established there were no clear histological differences between Perthes' disease and arthritis deformans, and since it was not generally known then that arthritis deformans can occur early in life, many cases of arthritis deformans were considered Perthes' disease. From the careful work of Axhausen the histological characteristics of arthritis deformans have been firmly established and it therefore follows that cases of this disease can be separated from all those claimed to be Perthes' disease. Since this has been the chief stumbling block up to this time in making the selection mentioned above, the selection now becomes much easier. Even so, it is far from satisfactory; and since the personal element can never be entirely excluded, it will probably not be agreed upon by any two observers.

In this paper I have attempted to select all the cases where a pathological examination has been made of the head of the femur, in cases which I consider to be Perthes' disease, using the criteria mentioned above. I intend to abstract briefly the histological picture in each case and compare them all with a case of my own. I shall also attempt to determine from this analysis what information can be obtained, if any, about the etiology and pathogenesis of this elusive condition. The case which I have studied comes from the service of Dr. Royal Whitman and was delivered into my hands through the kindness of Dr. Samuel Kleinberg. The clinical history follows:

Case 1. A. de G., aged sixteen. May 1, 1926.

Family History. Negative.

Past History. Usual childhood diseases, but no serious illnesses.

Present History. For the past two months the patient had noticed gradual onset of a right-sided limp, with toeing in of the right foot, and slight pain in the right hip. There was no previous history of injury. Patient was able to walk unassisted.

Physical Examination, on May 4, 1926: Negative except for local condition. Local condition: there was a flexion and adduction deformity of the right limb with marked restriction of motion of the right hip joint. There was tenderness on pressure over the head of the femur but no shortening of the leg.

Roentgen Ray. There is flattening of the head of the femur, with extension of the capital epiphysis backward onto the neck, to very near the trochanter. The inner half of the head is but little changed from the normal. The neck is broadened and somewhat shortened with slight increase in density at about its middle. Roentgen-ray diagnosis: Legg-Perthes' disease.

Operation. May 4, 1926. Right hip was stretched until the deformity was completely corrected and the limb brought into complete extension and abduction of 30°. A plaster of paris spica from nipple line to the middle of the leg was applied. Roentgenogram after manipulation showed that the pressure of weight bearing had been transferred from the flattened head to the extreme outer border of the head.

After Treatment. The patient was discharged on June 3, 1926, and not seen again until October 28, 1926. At this time the spica was removed and the patient was seen to have 5° to 10° of abduction. He still had some pain on pressure over the head of the femur. A short spica was applied and the patient was discharged.

On his next return Jan. 11, 1927 the right limb was again seen in a flexion-adduction deformity and abduction was entirely checked. The patient, however, was symptom free. Another stretching was advised but patient refused to permit it. A plaster spica was applied and patient advised to return in four to six weeks.

In March, 1927, the patient returned walking with a marked limp but with no pain. The limb was completely extended and slightly adducted. There was moderate muscular atrophy and shortening of one inch. Dr. Whitman's note at this time clearly describes the situation: "He returns after having worn a nondescript spica. The limb is now completely extended and slightly adducted. There is moderate atrophy. The original intent in this case was, as the head of the femur was flattening under pressure, to put it in extreme abduction, that the point of pressure might be removed to the outer part of the head. In the original picture taken here, this seems to be accomplished, but in the interval the plaster has not fullfilled its functions. The progress of the disease is very marked. A picture taken in the autumn shows a very marked flattening of the epiphysis and a picture taken at the present time shows that the process has advanced very much. The epiphysis, of the cap type described by Legg, has been extended outward so that it now practically reaches the trochanter, and the weight bearing is done only on a small section of the head, which is completely flat. As a result, the range of abduction is completely checked. The limb is now practically completely extended and there is a range of flexion of about 70°.

Patient now walks with a marked limp (limp evidence of adduction). He states he has no pain. As this process has gone on so rapidly, a reconstruction operation will be done as he has probably reached his full growth, about five feet, ten inches, and there is also considerable shortening from the flattenting of the head.

Second Operation. March 28, 1927, Dr. Whitman: The joint was opened in the usual manner and the head of the bone extruded. It was found to be flattened and irregular in outline and was entirely removed. The acetabulum was found to be fairly covered with cartilage except just beneath the outer rim and about the ligamentum teres there seemed to be formation of new tissue. The trochanter was replaced in the usual manner and the limb placed in a long spica in extension and 20° of abduction.

The patient was seen three months after operation June 11, 1927. At this time he was able to walk around with the aid of a cane without any pain. The limb is completely extended and abducted to 20°. There is a range of flexion of 15°. Roentgenogram shows that the reconstruction operation has been entirely satisfactory.

EXAMINATION OF SPECIMEN

Macroscopic Appearance (Fig. 1). The surface of the head of the femur was markedly flattened and thrown into three main folds, with deep crypts in between. The surface cartilage was clear, white and glistening, and followed the irregularities of contour without apparent loss of substance. From the pinkish tissue beneath, one could see that the cartilage varied in thickness and in one area was so thin that the granular spongiosa could be distinctly seen (A). In the depths of one of the crypts a dark red area 1 cm. in diameter was visible through the cartilage, having the appearance of a subchondral hemorrhage (B). An area about 3 cm. in diameter was denuded completely of its cartilage from operative trauma (C). In only one small area at the edge of the specimen laterally was a fairly regular spherical contour observed (D). On the outermost circumference of the head, the cartilage was somewhat lifted up from the underlying bone and hung in several shreds, with pieces of the capsular ligament attached to it (E).

Technique. The entire specimen was fixed in 10 per cent formalin for one week. It was then cut into three main pieces, one of the lines of section passing through the thin area of cartilage, and the outer through the furrowed area. The blocks thus obtained were fixed for four days more

in 10 per cent formalin, decalcified in 5 per cent nitric acid and then embedded in paraffin and cut as thin as possible. Ordinary hematoxylin and eosin stains were made, as well as Weigert's elastica stain for blood vessel structure.

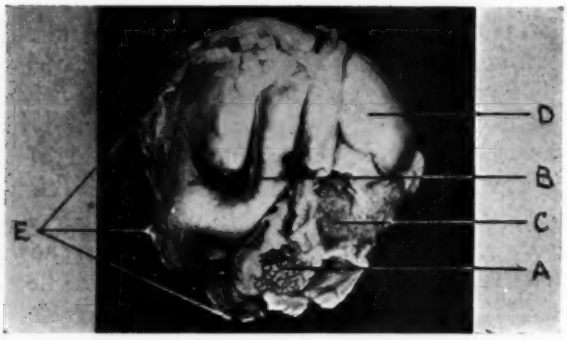

Fig. 1. Drawing of gross specimens viewed from above (slightly reduced). A, thinned out area of cartilage; B, deep crypt with subchondral hemorrhage; C, area of loss of cartilage from operative trauma; D, lateral portion of head with fairly spherical contour; E, shreds of capsule attached to cartilage.

Appearance of Fresh Cut Section (Fig. 2 and 3). The cartilage varied in thickness from 1/2 mm. to 5 mm. and at the point of greatest thinness (Fig. 1, A) was torn by the passage of the saw (Fig. 2, A). At the junction of the bone and cartilage, the lesion was readily seen. Throughout the entire breadth of the surface of the specimen the cartilage was separated from the apparently normal bone by a broad band of reddish tissue of putty-like consistency. This band varied in depth and its deepest part was no more than 1 cm. from the surface cartilage. In one area it occupied a cleft between bone and cartilage 5 mm. deep and 2 mm. long (Fig. 2, B) and communicated with the surface through the above mentioned tear in the cartilage. Only on the very rim of the specimen did the reddish mass merge into a fine pink line, representing the normal spongiosa. (Fig. 2, C). Embedded in the reddish material were several small islands of whitish tissue having the consistency of cartilage (Fig. 3, A). These were loose and could readily have been picked out. A distinct epiphyseal line was nowhere to be seen. However, on tracing the surface cartilage laterally it was found to be continuous with one of the islands just mentioned, which suggested that the island represented the remains of the epiphyseal line. The bony tissue further down appeared grossly normal, its trabeculae being of apparently normal thickness.

Microscopic Appearance (Figs. 4 to 10). Under low magnification (Figs. 4 and 5) the description of the fresh cut surface is readily verified. The reddish material is seen to be composed of completely disorganized bone and marrow, and is surmounted by normal cartilage of varying thickness. At the thinnest area, where the section is torn, the thinning out is seen to be due to encroachment of the disorganizing process from below (Fig. 4, A). Figure 5, A shows well the cartilage island suggesting the remains of the epiphyseal line. As can be readily seen from these two figures, the process is not the same in all areas. Indeed, it is a most complicated picture and for the sake of clarity only a few representative areas will be described (indicated by squares on Figs. 4 and 5).

The cartilage is normal, and passes over

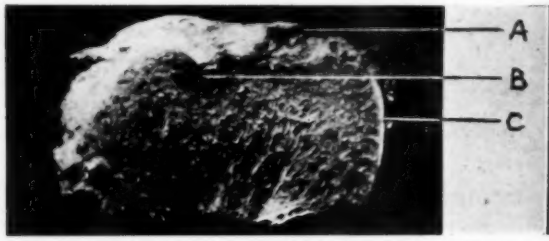

Fig. 2. Fresh cut section (natural size). A, Tear of surface cartilage from passage of saw; B, cleft beneath cartilage containing necrotic bone; C, normal cartilage and bone.

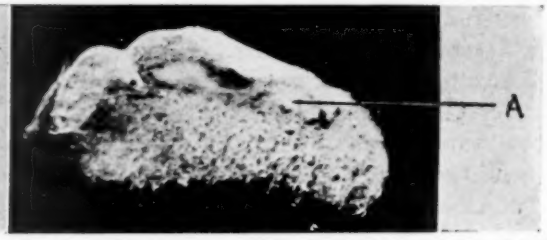

Fig. 3. Fresh cut section (natural size). A, Cartilage island. Note varying thickness of cartilage.

into completely necrotic spongiosa. The change from well-stained cartilage nuclei to bone tissue showing no nuclear stain, is a very striking one. In the deeper levels one encounters necrotic and fragmented bone has been described by other observers). The granulation tissue forms a more or less definite wall around the necrotic areas and becomes continuous with a zone of dense fibrosis of the marrow at their junction

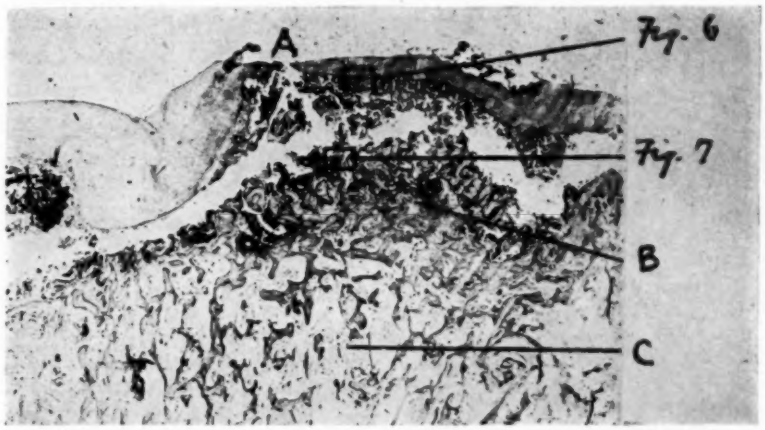

Fig. 4. (See figure 2) Microscopic section (× 3). A, Tear of surface cartilage from passage of saw; B, dense fibrosis of marrow beyond area of necrosis; C, poorly cellular fatty marrow. The squares indicate the areas for figures 6 and 7.

lamellae, lying in a matrix of degenerated marrow and blood (Fig. 6).

Still deeper (Fig. 7) one sees the fragments of the necrotic bone, surrounded by a loose granulation tissue containing with the normal bone lamellae below (Fig. 4, B). This fibrosed marrow gradually passes over into a poorly cellular fatty marrow (Fig. 4, C).

In other areas the necrotic process is less

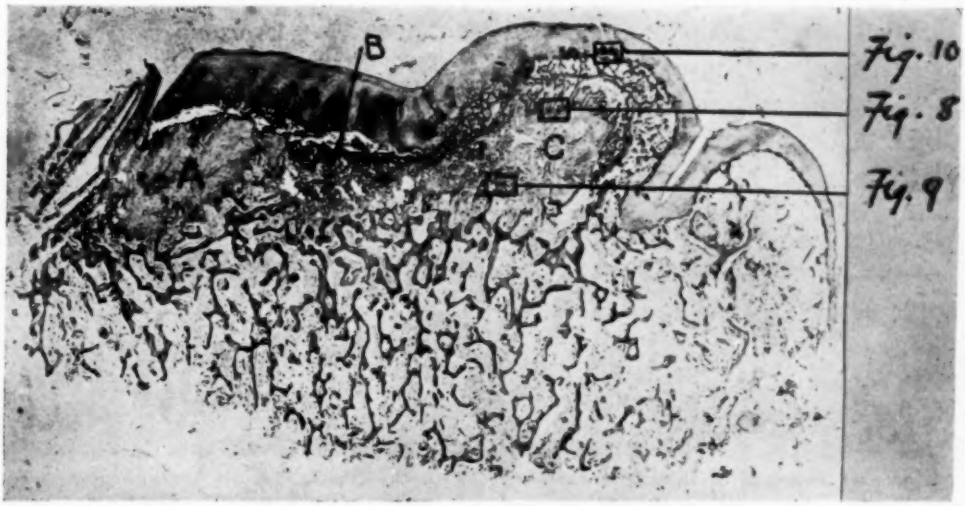

Fig. 5. (See figure 3) Microscopic section (× 3). A, Cartilage island; B, fresh necrosis; C, fibrous tissue. The squares indicate the areas for figures 8, 9, and 10.

many blood vessels and multinucleated giant cells (osteoclasts). This tissue is all densely infiltrated with red blood cells, but contains no polymorphonuclear leucocytes, plasma cells nor eosinophiles (as pronounced. Here one sees replacement by a more or less dense fibrous tissue, rich in capillaries but poor in cellular elements. In many areas the fibrous tissue assumes an embryonal appearance and appears to

give rise to new-formed cartilage. This has been described as metaplasia, but probably represents the development into osseous

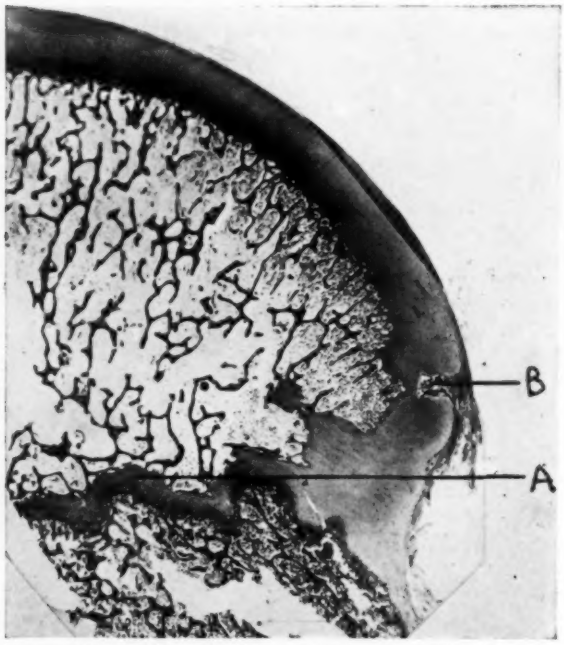

Fig. 5A. Normal head of femur in a young girl (× 3) for comparison. A, Normal epiphyseal line; B, vessels at junction of surface with epiphyseal cartilage.

tissue of a multipotential menenchyme. The cartilage island referred to above consisted of newly formed cartilage and probably is an example of this "metaplasia." Although it occupied the site of the old epiphyseal line, its histological appearance makes it seem very unlikely that it is the remains of that structure.

Besides the cartilage formation directly from connective tissue, there is abundant osteoid tissue laid down on the basis of preexisting bone lamellae. This osteoid tissue is absent where the necrosis is most marked, and is present only where the necrotic tissue has been absorbed and replaced by fibrous tissue. By far the greatest amount of new formed bone is of this "appositional" variety (Figs. 8 and 9). Throughout the involved area the picture of lacunar absorption is frequently seen, and it is not uncommon to see absorption of bone by osteoclasts on one side of a bone lamella and osteoblastic activity on the other. The blood vessels in all sections were carefully studied to detect, if possible, any obliterative thickening such as that described by Konjetzny, but none was found.

In the above description, very fine histological details have been eliminated for the sake of clarity and because their recital would obscure the outstanding changes which I wish to emphasize. There is one finding, however, the exact significance of which is not clear, but which probably has some bearing on the early changes that take place in this disease. It consists of widely dilated blood vessels between the spongiosa and the cartilage, bordered above by normal cartilage, and below by irregularly calcified bone (Fig. 10). Such a picture occurs only in an area where the spongiosa contains well pre-

Fig. 6. (See figure 4) Junction of bone and cartilage (× 150). A, Normal cartilage (note well stained nuclei); B, necrotic bone (see loss of nuclear stain); C, necrotic marrow and blood.

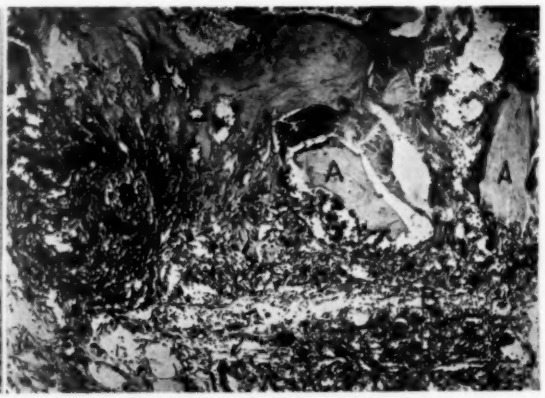

Fig. 7. (See figure 4) Area of necrosis (× 150). A, Fragments of necrotic bone; B, granulation tissue infiltrated with blood containing many giant cells.

served bone cells and has maintained its structure.

To summarize the pathological findings briefly, we have:

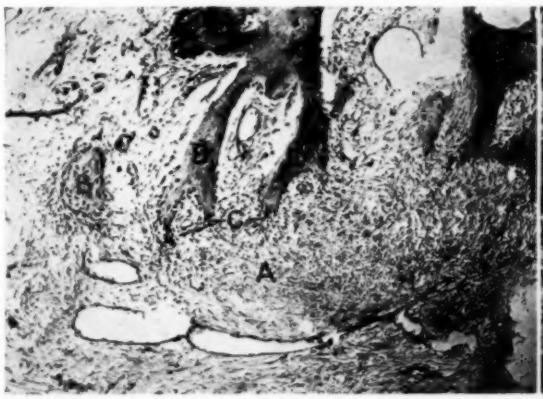

Fig. 8. (See figure 5) Area of repair (× 150). A, Embryonal type of fibrous tissue; B, osteoid tissue; C, osteoblasts.

Fig. 9. (See figure 5) Area of repair (× 150). A, Loose fibrous tissue; B, new formed bone; C, osteoblasts.

1. Extensive subchondral necrosis of bone and marrow.

2. Complete destruction of the epiphyseal line.

3. Fragments of dead bone, surrounded by richly vascular granulation tissue containing many multinucleated giant cells.

4. Fibrous tissue replacement of necrotic areas.

5. Osteoid tissue formation from fibrous tissue and from preexisting bone lamellae.

6. Dilated blood vessels in the undersurface of the cartilage.

Despite the tremendous literature on Perthes' disease, there have been only eleven cases examined histologically, and three of these represent merely fragments of tissue removed at operation. The eleven cases were reported by eight authors, and in order to compare their findings with mine I shall abstract briefly the pathological picture of each. For the sake of brevity I have omitted all reference to clinical and roentgenological data, though it is to be understood that in every instance the findings were typical of Perthes' disease. Here also, tedious descriptions of finer cellular changes have been eliminated as unnecessary for our discussion. The cases follow in chronological order.

Perthes (1913).

Schwartz (1914), 1 case. After two years of symptoms a boy of seven years was subjected to operation because of the suspicion of tuberculosis. At operation it was seen that the surface of the head of the femur was flattened and indented, and extended over the neck in a broad roll. A wedge-shaped segment was removed, which

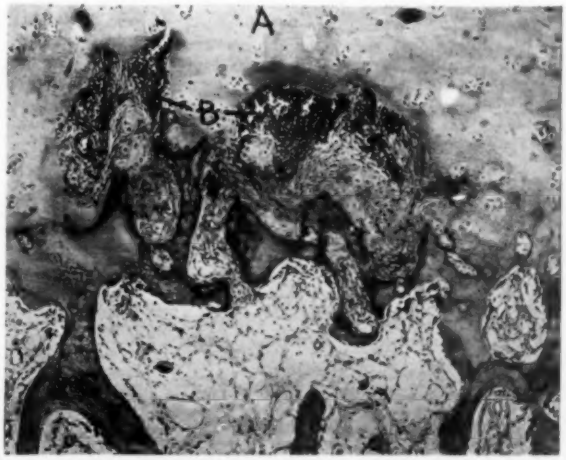

Fig. 10. (See figure 5) Junction of bone and cartilage where there is no subchondral necrosis (× 150). A, Normal cartilage; B, dilated blood vessels between cartilage and bone; C, normal spongy bone.

showed the following: the joint cartilage was normal. Beneath it were seen many islands of bone and cartilage surrounded by fibrous tissue and fatty marrow. There was no mention made of further histological findings and if it were not for incontrovertible roentgenological evidence one

might not be sure that the case was one of Perthes' disease.

Phemister (1920), 1 case. This was a boy of ten who was operated on eight months after the onset of symptoms. It was noted that the surface of the head of the femur was markedly distorted and flattened, but that the cartilage was unimpaired. A small window was cut out for histological study. In removing the specimen, a cavity containing necrotic debris and several small sequestra was opened into. The specimen showed intact cartilage, subchondral necrosis of bone and marrow and a richly cellular granulation tissue containing giant cells surrounding dead bone fragments. Cultures of the necrotic material in the cavity were sterile.

Axhausen (1923), 1 case. At autopsy the head of the femur of a nine year old child showed the following: the spherical shape of the head was preserved and the only surface irregularity seen was a small depression at its highest point. The cartilage was intact. On section the diaphysis and epiphyseal line were normal. The subchondral bone and marrow were necrotic and were surrounded by an outgrowth of young connective tissue, apparently springing from the angle between the surface and the epiphyseal cartilage. Some early new bone formation was seen being laid down on the old spongiosa lamellae. No leucocytic exudate was encountered.

Heitzman (1923), 2 cases. The first case was that of a nine year old boy in whom a resection of the head of the femur was carried out. The surface of the head was practically flat, having a slight convexity only at its outer part. The epiphyseal cartilage lay only 6 mm. from the surface. Between the two cartilaginous surfaces was a broad area of necrotic bone and marrow, enclosed in granulation tissue. Many osteoclasts were seen absorbing the necrotic rests. There appeared to be a bridge of cartilage extending from the epiphyseal line to the surface. Underneath the necrotic area there was a broad gap in the epiphyseal cartilage 1 cm. wide, through which projected a plug of granulation tissue extending downward into the diaphysis.

The second case was that of a 13 year old girl in whom a resection was also performed. Here also the head was remarkably flattened, with wrinkling and furrowing of the otherwise normal cartilaginous surface. On section the epiphyseal line had almost entirely disappeared with only a few fragments of cartilage remaining. Laterally under one of the furrows was a small cyst 1 cm. in diameter, appearing to extend into the diaphysis. Microscopically the joint cartilage was well preserved. In a cleft under the joint cartilage lay rests of necrotic bone and marrow. Fibrous tissue rich in cells and blood vessels penetrated into this area from the diaphysis and contained a fine network of new built bone.

Riedel (1923), 2 cases. The first case was that of a ten year old patient in whom operation was performed ten months after the onset of symptoms, the head of the femur being resected. The surface of the head was pressed flat and strongly indented. In the region of attachment of the ligamentum teres there was a grave-shaped depression. On section, a peasized free sequestrum was seen beneath the depression noted above. All around this was extensive necrosis of bone and marrow. The boundary between bone and cartilage was lost and the area filled with blood. The surface cartilage was slightly thickened and showed in its under surface small hemorrhages and islands of bone. The epiphyseal line was nearly completely destroyed, a few cartilage rests remaining. In the spongiosa a few small blood filled cysts were seen. In and around the necrotic bone fragments lay a richly cellular granulation tissue containing many giant cells, in some areas having the appearance of the giant cell tumor of bone. Further away the bone marrow was markedly fibrotic and contained an inflammatory infiltration with plasma cells, round cells, leucocytes, and eosinophiles. In some areas cellular osteoid tissue was seen. Osteoblastic activity and lacunar absorption

were going on together, often on the same bony lamella.

The second case, a boy of nine years, was operated on about ten months after the onset of symptoms. The surface cartilage of the head of the femur showed a crescent shaped depression beneath which the bone felt very soft. While a small fragment was being removed it was noted that the subchondral region was softened, of reddish color, and contained several gray-green areas (cartilage islands?). Microscopically, the fragment removed showed edematous connective tissue containing scattered hemorrhages and an inflammatory infiltration around the vessels.

Walter (1925), 1 case. A boy of seventeen years with a history of polyarticular rheumatism two and a half years before admission, of many months duration, came to the hospital because of persistence of symptoms in the right hip joint. At operation the head of the femur was resected. The head was flattened and mushroom shaped. Its cartilaginous surface was markedly distorted and denuded, in great measure, of its cartilage. Through the denuded areas extruded a reddish tissue. The ligamentum teres was lacking. The acetabulum showed the same denudation of cartilage as the surface of the head of the femur. On section the surface cartilage was of varying thickness and markedly irregular. At the junction of cartilage and bone were several cherry red areas, triangular in shape, with their bases toward the joint surface. These areas extended down half the way to the epiphyseal line, which was intact. Microscopically the cartilage was seen to be nearly completely destroyed and replaced by granulation tissue which had given the reddish appearance to the surface. The cherry red areas were seen to be composed of necrotic bone and marrow surrounded by blood and granulation tissue. Many giant cells were seen absorbing the necrotic bone fragments, and eosinophiles, plasma cells, and leucocytes were scattered throughout the granulation tissue. Into the granulation tissue osteoid tissue was growing from remains of the spongiosa and from bony trabeculae, which were simultaneously undergoing lacunar absorption.

Konjetzny (1926), 2 cases. The first case was a boy of seventeen who was subjected to operation five and a half months after the onset of symptoms. The head of the femur was resected and showed the following picture: Its surface was somewhat sloping and irregular, but was still distinctly spherical. The cartilage was intact throughout. "An antero-posterior section showed an extensive infarct-like subchondral necrosis of a depth of 1½ cm., extending as a flat area for 3 to 4 cm." Microscopically there was complete bone and marrow necrosis in the above mentioned area with hemorrhagic infiltration. On the border of the necrotic area was a well demarcated zone of cell-rich granulation tissue containing many multinucleated giant cells quite resembling the tissue of the giant cell tumor. In the surrounding living bone there was fibrous invasion of the marrow. The capsular vessels showed striking obliterative thickening.

The second case was a child who died of pulmonary tuberculosis eight years after the onset of Perthes' disease. At autopsy the affected head of the femur was found to be markedly deformed; with the neck and the great trochanter it formed one large cylindrical mass. The surface cartilage was for the greater part normal, but in the region of the ligamentum teres it was irregular, somewhat thickened, and scar-like. On section, the epiphysis was markedly diminished in size and the epiphyseal line was nearly completely destroyed. The subchondral bone trabeculae were markedly thickened and in a large area were broken up into many small necrotic fragments. In the region of the ligamentum teres the surface cartilage was from two to four times the normal thickness and overlay small cystic areas containing small islands of cartilage. The necrotic fragments were composed of dead bone, as shown by their trabecular struc-

ture. The surrounding bone showed abnormally thick trabeculae, with marrow spaces filled with cell-poor but highly vascular fibrous tissue. Further away the bone and marrow were normal. The diameter of the acetabulum in this area was one-third larger than normal. Konjetzny considered this case to be in an advanced stage in healing, but called attention to the fact that even after eight years there were present necrotic bone fragments and cartilage islands. The healing was therefore far from complete although the patient had long been symptom free and the roentgenogram had shown what appeared to be complete ossification.

Rockemer (1927), 1 case. A thirteen year old boy was operated upon ten weeks after a fall on the right side, because of persistance of severe pain in the right hip. The head of the femur was resected and showed a normal spherical shape with intact cartilage. On section the cartilage was of uniform thickness, but separated from the underlying bone for about two-thirds of its extent. In the cleft thus formed lay soft reddish tissue and in one area a small sequestrum. The epiphyseal line appeared to be intact. Microscopically, the surface cartilage was normal. The subchondral bone was completely necrotic and surrounded by blood and granulation tissue. The sequestrum was buried in a cell-rich and highly vascular granulation tissue containing many giant cells. The bone lamellae somewhat further away were undergoing lacunar absorption and were separated by fibrosed marrow tissue. Some osteoblastic activity was seen in the angle formed by the surface and epiphyseal cartilages where some normal bone was encountered.

DISCUSSION

It can readily be seen from a perusal of these protocols and the chart constructed therefrom that whatever differences there are between one case and another, are but slight. They all show deformity of the surface contour of the head of the femur, varying from a slight depression to marked flattening and furrowing. In all cases but one the surface cartilage was intact, and in that one (Walter) the previous inflammatory hip disease may account for the cartilage destruction. The condition of the epiphyseal line varied considerably. In the cases of relatively short duration it was well preserved. In those of longer duration it was interrupted or nearly completely destroyed. The fact that it was intact in three very definite cases of Perthes' disease would seem to point to the fact that this is not a primary disease of the epiphyseal line. It is quite striking that islands of cartilage were found in those cases in which the epiphyseal line was reported as interrupted or destroyed. This suggests that in some cases the cartilage islands represent remains of the epiphyseal line, while in others they are formed, as most authors believe, as part of the disease process. The most outstanding finding in all of the cases was the extensive subchondral necrosis of bone and marrow and the presence of a richly vascular granulation tissue. That the granulation tissue contained many multinucleated giant cells in the large majority of instances is not to be wondered at, as they are to be expected where dead bone is present. Of more interest is the report of the presence of leucocytes, plasma cells, and eosinophiles. It is on the basis of the finding of these elements that the inflammatory theory of Perthes' disease stands or falls. Out of the twelve cases such cells were reported as present in five instances, scattered throughout the granulation tissue. In three other cases the authors made a special point of noting that such cells were nowhere to be seen and in the remaining four, no mention was made of such a finding. In no instance were they found forming an infiltrated zone completely surrounding the necrotic area and no picture was described even remotely resembling an abscess cavity. It is also worth noting that bone marrow normally contains all the above mentioned cells in

Author and date	Age	Duration of disease	Gross					Microscopic												
			Shape of head of femur	Condition of surface cartilage	Ligamentum teres	Condition epiphyseal line	Cartilage islands	Structure of surface cartilage	Subchondral necrosis	RBC	Granulation tissue	Giant cells	Leucocytes plasma cells eosinophiles	Healing	Cyst-like spaces	Sequestra	Fibrosis of marrow	Lacunar absorption	Changes in blood vessels
Perthes-Schwartz 1913–1914	7	2 yrs.	Flattened and furrowed	Intact			Present	Normal			+						+		
Phemister 1920	10	8 mos.	Flattened and furrowed	Intact		Interrupted	Present	Normal	Extensive	+	+	+	+			+				
Axhausen 1923	9		Spherical with slight depression	Intact		Intact		Normal	Extensive		+		Absent	Small amount of osteoid tissue						
Heitzman 1923	9		Flattened and furrowed	Intact		Interrupted	Present	Normal	Extensive		+	+								
Heitzman 1923	13		Flattened and furrowed	Intact		Destroyed	Present	Normal	Extensive		+	+	+	Small amount of osteoid tissue	+					
Riedel 1923	10	10 mos.	Flattened and furrowed	Intact		Destroyed	Present	Normal with small islands of bone	Extensive	+	+	+	+	Small amount of osteoid tissue	+	+	+	+		
Riedel 1923	9	10 mos.	Spherical with small depression	Intact			P.esent	Normal	Moderate		+		+							
Walter 1925	17	2½ yrs.	Slightly flattened and furrowed	Badly damaged	Absent	Intact	Absent	Necrotic and partially exfoliated	Many small pyramidal shaped areas	+	+	+	Few scattered	Extensive osteoid tissue formation	0	0	+	+		
Konjetzny 1926	17	5½ mos.	Spherical but irregular	Intact				Normal	Extensive	+	+	+					+		Marked obliterative thickening	
Konjetzny 1926		8 yrs.	Markedly deformed	Intact		Destroyed	Present	Normal	Moderate	+	+			Solid bone formation						
Rockemer 1927	3	10 wks.	Normally spherical	Intact		Intact	Absent	Normal	Moderate	+	+	+	Absent	Very slight osteoplastic activity	0	+	+	+		
Zemansky 1927	16	1 yr.	Flattened and furrowed	Intact	Absent	Destroyed	Present	Normal with few small hemorrhages in under surface	Extensive	+	+	+	Absent	Slight osteoid tissue formation	0	0	+	+	None observed	

fairly large quantities and their presence, therefore, need not necessarily be looked upon as pathological at all. The finding of sequestra in three cases is somewhat puzzling. By a sequestrum I understand a relatively large fragment of dead bone, not a few bony lamellae, and since all the bone of the epiphysis is of the spongy variety it is hard to imagine where a large fragment could come from. Many authors report varying degrees of ossification of the epiphyseal line, and it might very well be that the fragments described as sequestra are really epiphyseal rests, well ossified. Fibrosis of the bone marrow and the phenomena of lacunar absorption were present in about half the cases, but they represent findings more or less to be expected in any process where there is extensive bone destruction. In six cases of moderate duration osteoid tissue was noted growing out into the granulation tissue and in the case of eight years' duration solid bone was observed. This finding is of great importance, as it represents the extent of spontaneous healing. The fact that in the cases lasting two years or more only relatively little replacement by osteoid tissue was seen (in comparison with the large area of necrosis) shows how little can be expected from this method of healing. Of great significance also is the finding, in an isolated case by Konjetzny, of definite obliterative changes in the blood vessels. No other authors appear to have observed this and in my case even after the most careful search I was unable to detect any abnormality either in the vessels between bone trabeculae or in the cluster of vessels normally present in the angle formed by the surface and epiphyseal cartilage. The vessels which are known to run in the ligamentum teres could not be examined, as neither that structure nor any of its remains could be identified. It is of interest that in one other case it was recorded that the ligamentum teres was lacking. That this may have some bearing on the pathogenesis of the disease will be pointed out later.

What, then, gives rise to all these changes? If one were to quote the opinions of all who have written on this subject, it would only lead to confusion because most authors have drawn their conclusions from purely clinical and roentgenological studies. I will mention only a few of the authors, leaving the pathological evidence to speak for itself. Those who desire the whole literature at a glance will find it abstracted in Riedel's paper.

Eight main processes have been considered responsible for Perthes' disease by different observers. They are:

1. Tuberculosis or syphilis
2. Rickets
3. Constitutional factors
4. Arthritis deformans
5. Infection
6. Trauma
7. Embolic vascular occlusion
8. Traumatic vascular occlusion

1. *Tuberculosis or Syphilis.* The pathological evidence so far reported makes it seem hardly possible that either of these two diseases may be responsible for Perthes' disease.

2. *Rickets.* The disturbance of the epiphyseal line in Perthes' disease is of a type never observed even in far advanced rickets. Besides, as previously noted, Perthes' disease may occur without any disturbance of the epiphyseal line. This theory may therefore be quickly dismissed.

3. *Constitutional Factors.* Under this heading come the theories of endocrine dyscrasia, developmental anomalies, and constitutional predisposition. Such theories have arisen from the fact that endocrine types, skeletal abnormalities elsewhere, and slight similiar roentgenogram changes in the mother have been observed in a very small series of cases (Büttner). Of course, one cannot say that such factors could not produce the pathological picture of Perthes' disease, but it is difficult to see how they can. The chief obstacle to the acceptance of these theories is the fact that never have Perthes' and Kohler's disease developed in the same individual,

nor does the disease ever assume a generalized form. Such causes as those mentioned above should act equally on all of the bones in the body, and not pick out specifically the head of the femur or the fourth metatarsal.

4. *Arthritis Deformans.* The pathology of this disease has only recently been adequately described and it has now been clearly shown by Axhausen and others that the marked destruction of cartilage and early massive bone formation with so called mosaic structure, sharply separate arthritis deformans from Perthes' disease. The factors which operate to produce arthritis deformans are not at all well defined; but, granted their presence, there is no reason why arthritis deformans should not develop secondarily on the basis of Perthes' disease. Riedel, who found degenerative changes, vascularization and small islands of bone in the surface cartilage in one of his cases, interprets them as beginning secondary arthritis deformans. This is certainly a significant observation, although the interpretation is open to question. As the patient grows older, the altered mechanics of the joint would seem particularly to favor the development of arthritis deformans, whether the original process were healed or not.

5. *Infection.* An acute inflammatory process of bone presents a clear and characteristic pathological picture. More chronic infections with organisms which have become avirulent are more difficult to recognize. Perthes' disease has been held to be an example of the latter. If it is a form of chronic osteomyelitis, it would have to be one of a very special nature, since there is no pus, no dense infiltrative wall and no involucrum formation. The absence of pus, particularly in the presence of extensive fresh necrosis of bone is hard to understand if the necrosis be due to an infectious agent. Although leucocytes, plasma cells, and eosinophiles scattered throughout the granulation tissue have been found in a few cases, these can be accounted for equally well by the destructive process without calling upon bacterial invasion to explain their presence. The fibrosis of the surrounding marrow present in all of the cases is in itself not specific of any type of disease. Positive or negative cultures of the necrotic material obviously do not aid us one way or the other, since negative cultures may mean that the organisms have died, and positive cultures may be looked upon as contaminations. Therefore, although the theory of the inflammatory nature of Perthes' disease cannot be entirely dismissed, one if forced to withold judgement until more evidence is brought forth to uphold it.

6. *Trauma.* Trauma can be looked upon in two ways. One as the immediate cause of some process such as a fracture, and the other as the predisposing factor for a secondary process such as infection or vascular exclusion. Those who hold trauma accountable for Perthes' disease have considered it in the first sense, and hence, according to this theory, Perthes' disease must be looked upon as a fracture or crushing injury of the head of the femur. The fragmented dead bone surrounded by blood, and the deformation of the surface of the head could well be accounted for by a crushing injury. In that case, however, it should follow immediately on the heels of the particular trauma and not develop slowly over several months' time. The absence of extensive callus formation and the negligible bony union even after two years do not fit in well with what is known about fractures in children. Trauma in this sense therefore does not answer the question satisfactorily. Considered in the light of a predisposing factor to some other process, however, trauma would account equally well for a secondary inflammatory process or vascular occlusion. The lack of convincing pathological evidence in favor of the former, as already pointed out, inclines one to the latter. This view is strengthened by significant experimental and clinical data soon to be cited.

7. *Embolic Vascular Occlusion.* Prac-

tically all agree that the whole pathological picture of Perthe's disease closely resembles an infarct. The localized necrosis, with or without hemorrhagic infiltration, and the fibrous tissue replacement are typical. The differences of opinion arise in the question of how the blood supply to the region is cut off. Schwartz described quite fully the blood supply of the head of the femur, and pointed out that three vessels would have to be plugged, if Axhausen's theory of the embolic origin of Perthes' disease were to be accepted. Two of the vessels are from the periosteum and enter the epiphysis through the angle formed by the surface and epiphyseal cartilages; the third enters through the ligamentum teres. (See section of normal head of femur, Fig. 5A.) It is asking too much of emboli to expect them to arise spontaneously from no apparent source, and to pick out these three small vessels to the exclusion of all other vessels in the body. Reduced to these terms this theory appears very weak, but the fact remains that a *disturbance of nutrition through some sort of occlusion of the vascular supply other than embolic would best account for the pathological picture seen in Perthes' disease.*

8. *Traumatic Vascular Occlusion.* In this last theory we have a combination and a modification of the two previous theories. Curiously enough, it was one of the first to be announced. In 1914 Schwartz, a pupil of Perthes, from exhaustive clinical and roentgenological studies, gave it as his opinion that some trauma to the vascular supply of the epiphysis of the head of the femur was responsible for Perthes' disease. He went even further, suggesting that injury to the vessel in the ligamentum teres came first, followed by injury to the two other vessels from altered joint mechanics. No one seems to have paid much attention to Schwartz's statements, probably because Perthes himself did not believe in them. Quite recently Rockemer has come to the same conclusions and I also feel that they represent the closest approach thus far obtained in the solution of the problem. Not quite analogous, but significant nevertheless, are the experimental results of Müller, who claims to have obtained the pathological picture of Perthes' disease in a few instances after producing epiphyseal separation or dislocation of the head of the femur in a large series of guinea pigs, rats, rabbits, and dogs. He performed his work on animals of all ages, but only those with a cartilaginous epiphyseal line developed bone necrosis. Although somewhat crude, this work gives us not only conformity of experimental findings with our own pathological data, but also offers for the first time, a satisfactory explanation of the age distribution of the disease. It is easy to imagine that in early youth before Perthe's disease has developed, the nutrition through the periosteal vessels and the ligamentum teres is exactly enough to ward off the occurrence of necrosis. It is now quite aggreed that no vessels penetrate the epiphyseal line from below and the epiphysis must rely on the aformentioned vessels for all of its blood supply. In adults with completely ossified femora the nutrition of the head is still possible through the neck, even after the destruction of all head vessels. This would seem to account for the absence of the disease commencing in adult life. Although a history of trauma cannot always be obtained, one must consider that, in the disposed age, a relatively slight injury may suffice to call forth the vascular lesion which will upset the nutritional balance of the head of the femur. It may be only a forced rotation or abduction or some sudden normal movement. Some anomaly in vascular arrangement may predispose toward injury of these vessels but whether normally placed or anomalous vessels are injured one need not postulate a complete arterial ischemia. Merely a quantitative diminution in the blood supply should be sufficient.

The presence of large amounts of blood in seven of the above reported cases strongly suggests hemorrhagic infarction,

which may come about from simple venous occlusion. The alterations in the vessel walls found by Konjetzny, the thinning out of the ligamentum teres in two cases as observed by Riedel, and Walter's and my own observation, that no trace of the ligamentum teres could be found, are all very suggestive in the light of the above conception. In Walter's case, particularly, the necrosis appeared to be confined to that region supplied solely by the vessel from the ligamentum teres. The surface contour of the head of the femur in his case was fairly well preserved, and the involvement of the remaining vessels from "altered joint mechanics," as Schwarz suggested, may not have occurred as yet. The clinical observation of Brandes, Putti, and Sudeck, that the roentgenological picture of Perthes' disease appeared to follow reposition of a congenitally dislocated hip is also significant in this regard.

If we should then try to reconstruct the story of Perthes' disease according to this theory, it would appear somewhat as follows: During childhood the blood supply of the epiphysis of the head of the femur by way of the periosteum and ligamentum teres is just adequate to maintain its nutrition, and in certain children, perhaps, differs in its anatomic arrangement. Following trauma, even though unnoticed, one or all of these blood vessels may be sufficiently damaged to interfere with the nutrition of the epiphysis, and necrosis of the subchondral bone and marrow takes place. The necrotic bone is readily fractured by weight bearing, with resultant deformation of the surface contour. Repair is slow, by means of fibrous tissue replacing the bony fragments. A small amount of osteoid tissue is formed from the fibrous tissue and by the surrounding live bone lamellae, but the blood supply of the region is too inadequate to bring about solid bony replacement. Eventually, as the child approaches adult life, an equilibrium is reached where the blood supply from the diaphysis is able to take care of whatever is left of the epiphysis. Just how long it takes for the entire involved area to become solid bone can be only surmised. In Konjetzny's second case, bonyre placement was not complete even after eight years, so that it would appear that it occurs very slowly. Symptomatically, however, Konjetzny's case appeared to be completely healed many years before the hip-joint was examined pathologically. It is extremely likely, therefore, that after the process has reached a certain balance between necrosis and fracture on the one hand, and replacement by fibrous and osteoid tissue on the other, pain at least disappears. Likewise, as the joint accommodates itself to the presence of a deformed femur head the limp and limitation of motion disappears. It is at this point that secondary arthritis deformans may well appear. The mechanical factors are certainly conductive to its development. As I mentioned above, many puzzling pathological pictures combining features of both diseases can be explained on this basis.

This whole conception of the nature of Perthes' disease can be carried one step further. If it is dependent upon some disturbance in the blood supply of the head of the femur, it may be brought about perhaps by any process of sufficient severity in the neighborhood of the vessels responsible for the nutrition of the head. Walter's case which showed considerable disturbance of the surface cartilage and loss of the ligamentum teres may have developed Perthes' disease through the previous inflammatory intra-articular process, but in this case one must also consider the extention, application of casts, and other therapeutic procedures employed, as potential sources of trauma.

It should be possible to clear up matters of this kind by experimental work, and indeed such work is already under progress by this author.

SUMMARY AND CONCLUSIONS

1. The resected head of the femur is described in a typical case of Perthes' disease.

2. The pathological criteria for the diagnosis of Perthes' disease are enunciated.

3. Eleven other instances of pathological examinations of heads of the femur in Perthes' disease are abstracted.

4. The various processes held accountable for Perthes' disease are reviewed and evaluated from the pathological data.

5. The theory of vascular disturbance of the femoral epiphysis from trauma is considered the most likely one to explain the pathogenesis of the disease.

The author wishes to thank Dr. Royal Whitman for permission to report this case, and Dr. Paul Klemperer for his valuable criticism of this work.

BIBLIOGRAPHY

1. Perthes, G. Über Osteochondritis deformans juvenilis. *Arch. f. klin. Chir.*, 1913, ci, 779.
2. Schwartz. Eine typische Erkrankung der oberen femur-epiphyse. *Beitr. z. klin. Chir.*, 1914, xciii.
3. Edberg, E. Studien uber die sog. Osteochondritis coxae juvenilis. *Zentralbl. f. Chir.*, 1919, xi, 206.
4. Phemister, D. Operation for epiphysitis of the head of the femur. *Arch. Surg.*, 1921, ii, 221.
5. Lang, F. Mikroscopische Befunde bei juveniler Arthritis Deformans. *Virchow's Arch. f. Path. Anat.*, 1922, ccxxxix.
6. Perthes, G. and Welsh. Über Entwicklung und Endausgänge der Osteochondritis Deformans des Hüftgelenks. *Beitr. z. klin. Chir.*, 1922, cxxvii.
7. Axhausen, G. Die Ätiolagie der Köhlerschen Erkrankung der metatarsal-Köpfchen. *Beitr. z. klin. Chir.*, 1922, cxxvii.
8. Axhausen, G. Die Arthritis Deformans, ihre Abarten und Behandlung. *Arch. f. klin. Chir.*, 1923, cxxv.
9. Axhausen, G. Der Anat. Krankheitsablauf bei der Köhlerschen Krankheit der metatarsalkopchen und der Pertheschen Krankheit des Hüftkopfes. *Arch. f. klin. Chir.*, 1923, cxxiv.
10. Riedel, G. Zur Path. Anat. und Ätiologie der Osteochondritis deformans coxae juvenalis. *Virchow's Arch. f. Path. Anat.*, 1924, ccxliv.
11. Heitzman, O. Epiphysenerkrankungen im Wachstumsalter. *Klin. Wchnschr.*, 1923, 397.
12. Müller, W. Experiment. Untersuchung ihrer Nekrose und Umbauprozesse am Schenkelkopf nach traumatischen Epiphysenwirkungen. *Beitr. z. klin. Chir.*, 1924, cxxxi.
13. Perthes, G. Über Osteochondritis Deformans coxae. *Klin. Wchnschr.*, 1924, Nr. 13.
14. Büttner, G. Ätiologie und Pathogenese der Pertheschen Krankheit. *Arch. z. klin. Chir.*, 1925, B, 136.
15. Walter, H. Zur Histologie und Pathogenese der Pertheschen Krankheit uns. *Arch. f. Ortbop.*, 1925, xxiii, 672.
16. Konjetzny. Zur Kentniss der Pertheschen und Köhlerschen Krankheit insbesondere der Heilungsvorgang bei diesen. *Tagung d. Deutsche Gesellsch. f. Chir.*, 1926, I.
17. Rockemer, K. Zur Histopathogenese der Pertheschen Krankheit, and der Hand eines Frühfalles. *Frankfurt. Ztschr. f. Path.*, 1927, xxxv.
18. Putti, V. Personal Communication, 1926.
19. Sudeck, P. Personal communication, 1927.

OBSERVATIONS ON LEGG-PERTHES' DISEASE

WITH PARTICULAR REFERENCE TO OPERATIVE TREATMENT*

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NEW YORK

IN May 1926 the patient, a well-developed boy sixteen years of age, was first seen at the Hospital for Ruptured and Crippled. He stated that for several months there had been discomfort in the right limb, of the nature of stiffness and sensitiveness in the hip joint and a persistent limp.

FIG. 1. Coxa plana of mild degree. The limb has been fixed in full abduction to relieve direct pressure.

It was noted that the patient was in good condition and that there was nothing significant in the family history. The right limb was flexed and adducted and the movements of the joint were somewhat restricted and painful. The roentgen-ray picture presented the characteristic appearances of coxa plana of a mild degree.

On the assumption that the progression of the deformity might be explained in part by pressure on a weakened epiphysis, which after a time might regain normal resistance, the limb, under anesthesia, was fixed in full abduction by a plaster spica. (Fig. 1.)

The patient lived at a distance and was not again seen till the following October. The long spica had in the interval been replaced by a short one which served no purpose other than to check movement in the joint and to restrain the activity of the patient. The second picture shows at this time an apparent atrophy of the structure of the neck at its junction with the epiphysis. (Fig. 2.)

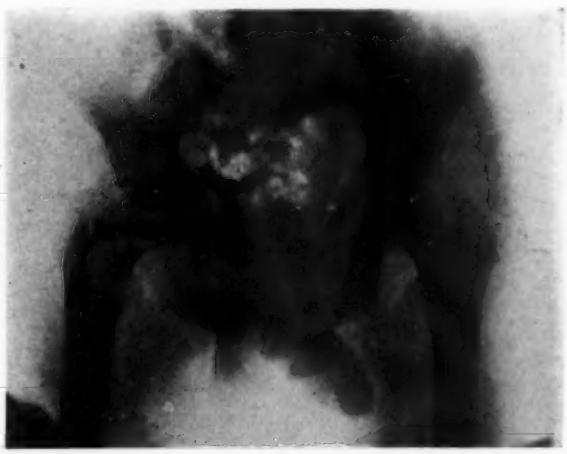

FIG. 2. Five months later, showing the progression of the deformity.

In March, 1927, the patient was again examined. The progression of the deforming disease to what was practically disorganization of the joint is clearly shown in the roentgenogram. (Fig. 3.) It was decided, therefore, to perform the recon-

* Read before the Section of Orthopedic Surgery, Academy of Medicine, October 21, 1927

struction operation. This was indicated by the evident mechanical restraint of abduction, and there was also the incentive that it would provide the opportunity for direct examination of the affected tissues.

On opening the joint it was noted that there was no trace of inflammatory disease, that the cartilage was intact but crumpled, not as if by pressure from without but rather by retraction from within.

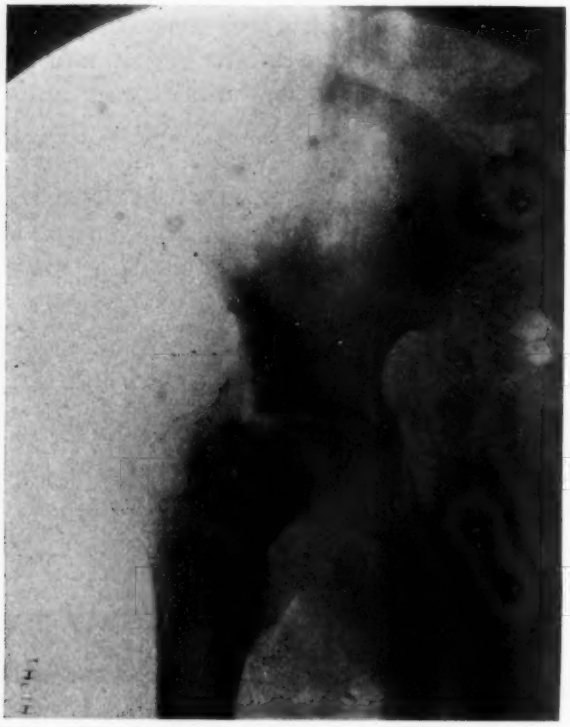

Fig. 3. Ten months after the first examination showing disorganization of the joint. Compare with Figure 1.

Fig. 4. After the reconstruction operation. Compare with Figure 3.

The epiphysis was removed, the neck, which seemed solid and resistant, was fashioned into a rounded extremity and the trochanter was transplanted to the outer border of the shaft. The patient left the hospital in June and has not been seen since. (Fig. 4.)

A comparison of the pictures taken before and after the operation will demonstrate the improvement in the mechanical relations. It would seem that as the source of weakness has been removed, and the deformity of flexion and adduction definitely overcome, the functional disability should be slight.

It may be recalled that originally the chief significance of this affection was thought to be its differentiation from actual disease of the joint, and that after a period of discomfort, varying from a few months to several years, recovery might be assured with little or no apparent disability.

At the present time this prognosis must be modified. Legg,[1] from an observation of his original cases through a period of many years, now divides them into two classes, a mushroom type in which the area of the head expands as indicated by the name, and the cap type in which the bone center becomes segmented and the epiphysis "migrates" toward the trochanter. In this form the symptoms are more persistent and disability greater. He concludes that treatment has but little influence on the result.

Flemming-Möller[2] from an observation

[1] Legg, A. T. End results of coxa plana. *J. Bone & Joint Surg.*, 1927, ix, 26.

[2] Flemming-Möller. Redundant colon. (In English.) *Acta Radiol.*, 1926, vi, 432.

of 74 cases states that in approximately 20 per cent there was persistent limp with more or less disability.

It would appear that the prognosis depends in great degree upon the character of the deformity; that the history of coxa plana is not completed in adolescence since as one of the so-called incongruities it may serve as a predisposing cause of arthritis deformans in later life. Consequently in cases like the one described in which the joint is practically disorganized operative intervention may be indicated as a preventive measure.

CORRECTION

IN my article on "Fractures of the Spine" published in the American Journal of Surgery, August, 1927 iii, 116–125, I stated:

"Others, as Speed, Scudder, Krause, Estes, Elsberg, Frazier, Bottomley, Allen, McWilliams, Taylor, Miller and Coleman, are distinctly in favor of the operation. Of course the skilled neurosurgeon would naturally favor the operation . . . The question of laminectomy is therefore very much disputed but I do not believe that with our limited number of cases we can tip the scales one way or the other. The decision to operate rested, as in every hospital, on the personal opinion of the examining surgeon or the neurologist. Dr. Taylor, our neurological surgeon, was naturally more inclined to the operation."

I have since learned from Dr. Taylor that I have misquoted him. He writes to me the following: "My firm conviction is that very few fractures of the spine should be operated upon and only those where the spinous process and laminae have been fractured and pushed in against the cord as the result of direct violence. It seems to me there is nothing to be gained by operating upon compression fractures of the spine except in very unusual cases that are quite different from the average."

I am anxious to have this correction brought to the attention of the profession to state Dr. Taylor's position correctly and avoid unnecessary operations.

Samuel W. Boorstein.

AN APPARENT RECOVERY FROM MULTIPLE SARCOMA*

WITH INVOLVEMENT OF BOTH BONE AND SOFT PART TREATED BY THE TOXINS OF ERYSIPELAS AND BACILLUS PRODIGIOSUS (COLEY)

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THE patient, Captain G. B., whose age upon admission on June 27, 1925, was 31 years, occupation master mariner, gave the following history: Sustained a bruise of left shin bone February 25, 1918, by being thrown against a hatch. The bruise soon healed and the leg appeared normal within six weeks. Thirteen months later he began to have severe pain at the spot where the skin had been bruised. This pain was accompanied by swelling and fever. The pain, but not the swelling, temporarily disappeared in about one week, followed by recurrent attacks of pain every two or three weeks, for a period of three months, during which time he was making a long voyage from Australia to New York. Shortly after his return to New York a roentgenogram of the leg revealed osteomyelitis of the tibia, and an operation was performed at St. Joseph's Hospital, Paterson, N. J., August 18, 1919. He remained in the hospital until November 23, 1919, and was still suffering pain at the time of discharge and walking on crutches.

He was admitted to U. S. Marine Hospital No. 21, New York, March 31, 1920, and remained until July 26, 1920, during which time he was treated by physiotherapy which relieved the pain. He went back to sea until March, 1921, and then came back to the hospital for two weeks, again back to sea off and on until March 3, 1924, when he was re-admitted to the Marine Hospital, New York, for operation for chronic appendicitis and bilateral inguinal hernia. He was discharged March 28, 1924, recovered of these conditions but still having occasional attacks of pain in the leg.

He was readmitted to the hospital May 10, 1924, and remained under treatment until September 25, 1924, during which time he received baking and ultraviolet rays to the affected leg. After discharge this time all pain had gone; there was no swelling and the patient appeared to be cured.

Figure 1 taken October 2, 1924, shows marked corticle thickening and irregularity of the middle third of the tibia with greater density of the cortex, obliteration of the medullary cavity in the middle third, and marked periosteal roughening with bony projections, especially anteriorly. At this stage the diagnosis was osteomyelitis.

On April 24, 1925 he noticed swelling in the shin bone a little higher up than the site operated on in 1919. He was readmitted to the hospital and operated on in May. Osteomyelitis was found with free pus in the marrow and a sequestrum of dead bone. About two weeks after this operation the bone began to "swell" and ache just below the knee.

Figure 2, taken June 30, 1925, shows marked decalcification of the upper third of the left tibia with only part of the skeleton of the bone remaining, appearing like a bone desolving under corrosive fluid in the anterior upper third of the tibia. Shortly afterwards injections of sodium

*This case was reported in *Military Surgeon*, July, 1927 (lxi, 42–47), but in view of the fact that it is of such unusual interest, we have decided to republish it in full with the important roentgenograms and microphotographs which were not included in the original report.

iodide were begun and given every third day intravenously until a total of fifty grams were given. Figure 3, made September 13, 1925, shortly after the sodium iodide treatment, shows further advance of the erosion, with pathological fracture at the junction of the upper and middle third of the tibia, anteroposterior and lateral views.

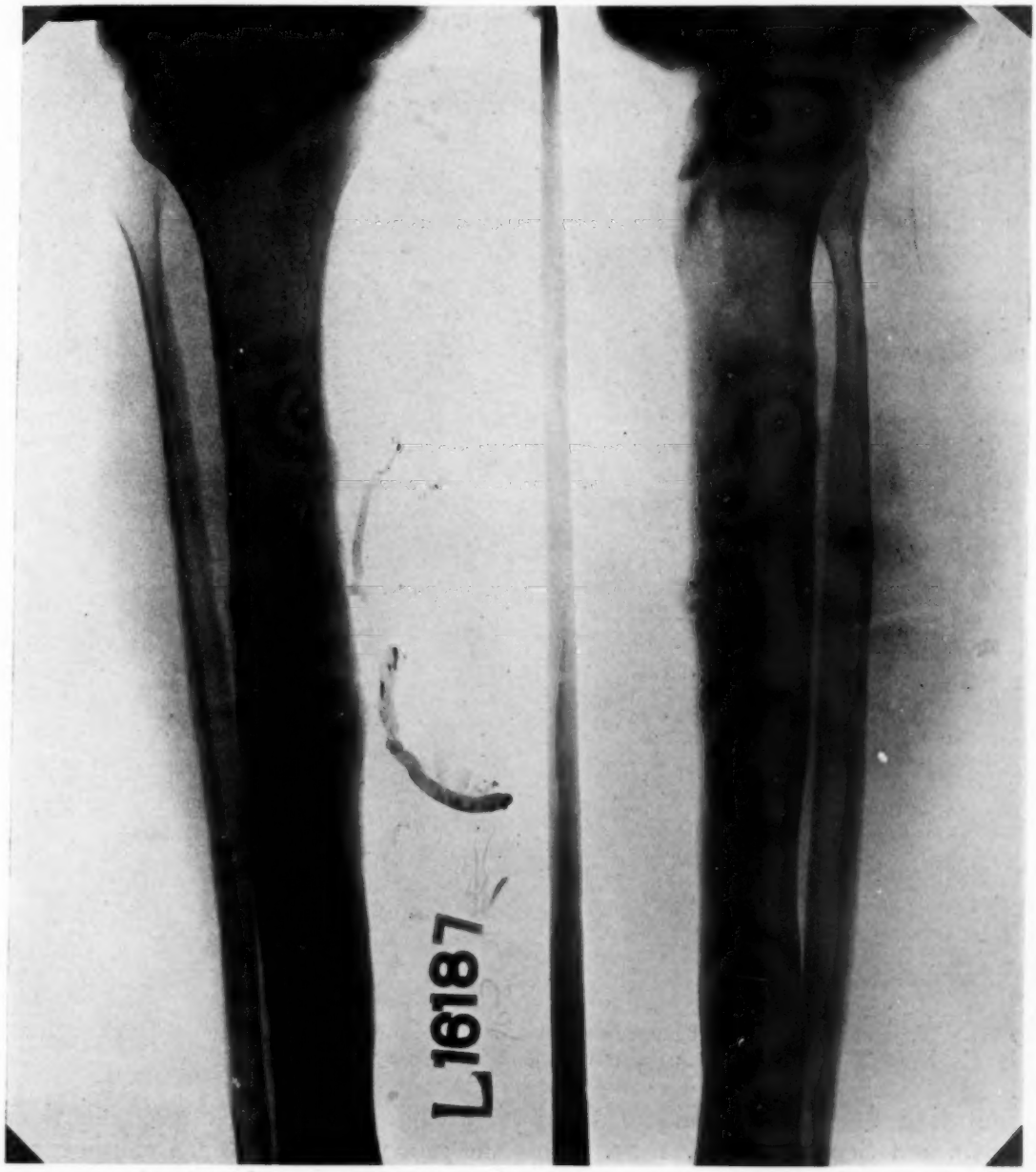


Fig. 1. October, 1924. Marked cortical thickening and irregularity; obliteration of medullary cavity; periosteal roughening. Diagnosis at this time: osteomyelitis.

On September 11, 1925, a small piece of bone was removed which was reported by the laboratory as myelosarcoma, very cellular, with slight fibro-sarcomatous structure: Figure 4 is a section through tumor of tibia. Fixation is in formalin 10 per cent. The growth is composed of a mass of cells without regular arrangement. The cell units are small, polyhedral, with indistinct borders, often appearing as a syncytium. They are very uniform in size.

The cytoplasm is clear and stains poorly. The nuclei are generally oval, with one, two or three distinct chromatin granules. Mitotic figures are frequent. Strands of fibrous tissue pervade the growth, in some areas more conspicuous than in others. Blood vessels are not numerous.

was reported by the laboratory as myelosarcoma metastatic. Figure 6 shows section through lymph-node in mid-line of abdomen, just above umbilicus. Fixation is in formalin 10 per cent. The normal structure of the lymph-node is entirely broken down replaced by the irregular masses of invad-

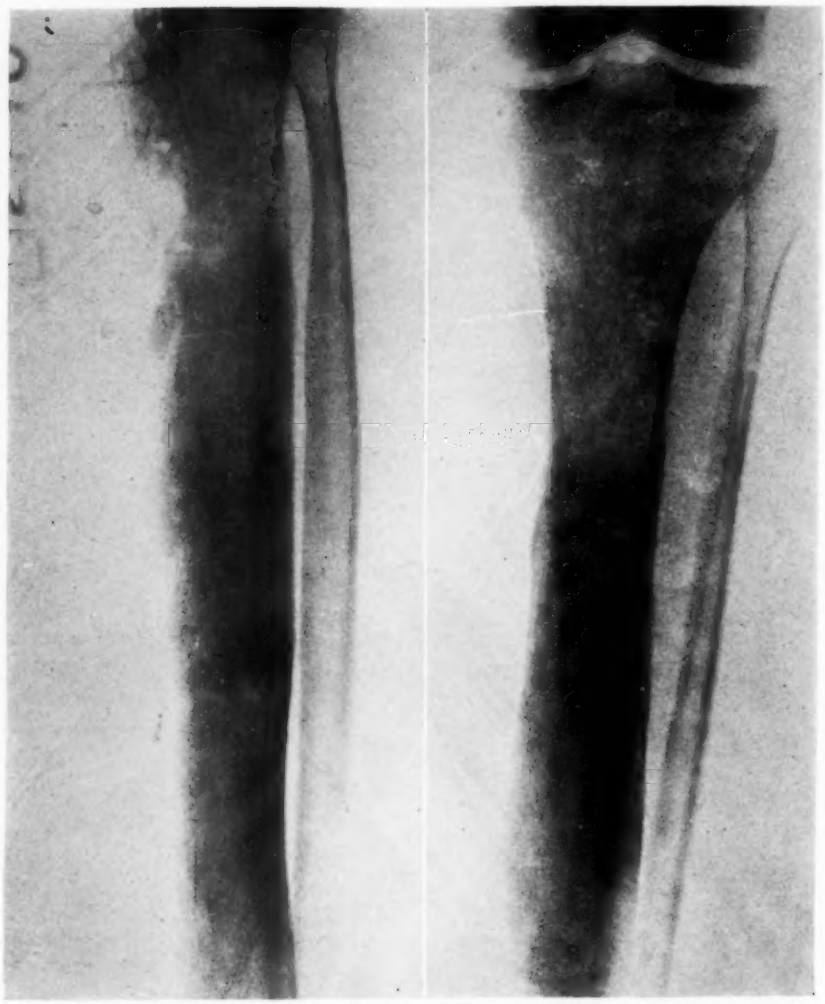


FIG. 2.—June 30, 1925, shows marked bone destruction or loss of calcium; condition now begins to resemble a sarcoma rather than an inflammatory process.

Amputation of thigh in middle third was performed September 21, 1925. The wound healed in two weeks.

The pain in the stump continued. Figure 5 of the stump of the left femur 60 days after amputation, shows the periosteum intact, the cortex and medulla sharply demarcated. On December 12, a nodule was noticed beneath the skin just above the umbilicus, a specimen from which

ing tumor cells which resemble those of the growth on the tibia. Lymphocytes are intermingled in places with tumor cells. Ewing Taylor was the pathologist.

January 5, 1926, the patient presented the following conditions: The end of the femur-amputated stump had a tumor mass about the size of a man's fist on its inner aspect, with an additional growth about the size of a lemon, over its outer aspect.

The skin of the stump appeared quite healthy. There was a mass of new growth in the left inguinal region which was about 2 inches long, 1 inch wide and 2 inches thick. There was a supraumbilical mass which involved the skin. This mass was about ¾ of an inch in diameter. The quite severe (Chart A). Subsequent series of injections after the patient had established tolerance for Coley's toxins, did not produce such reactions, even with large doses (Chart B).

On January 22, the circumference of the stump was 17⅛ inches. The mass in the

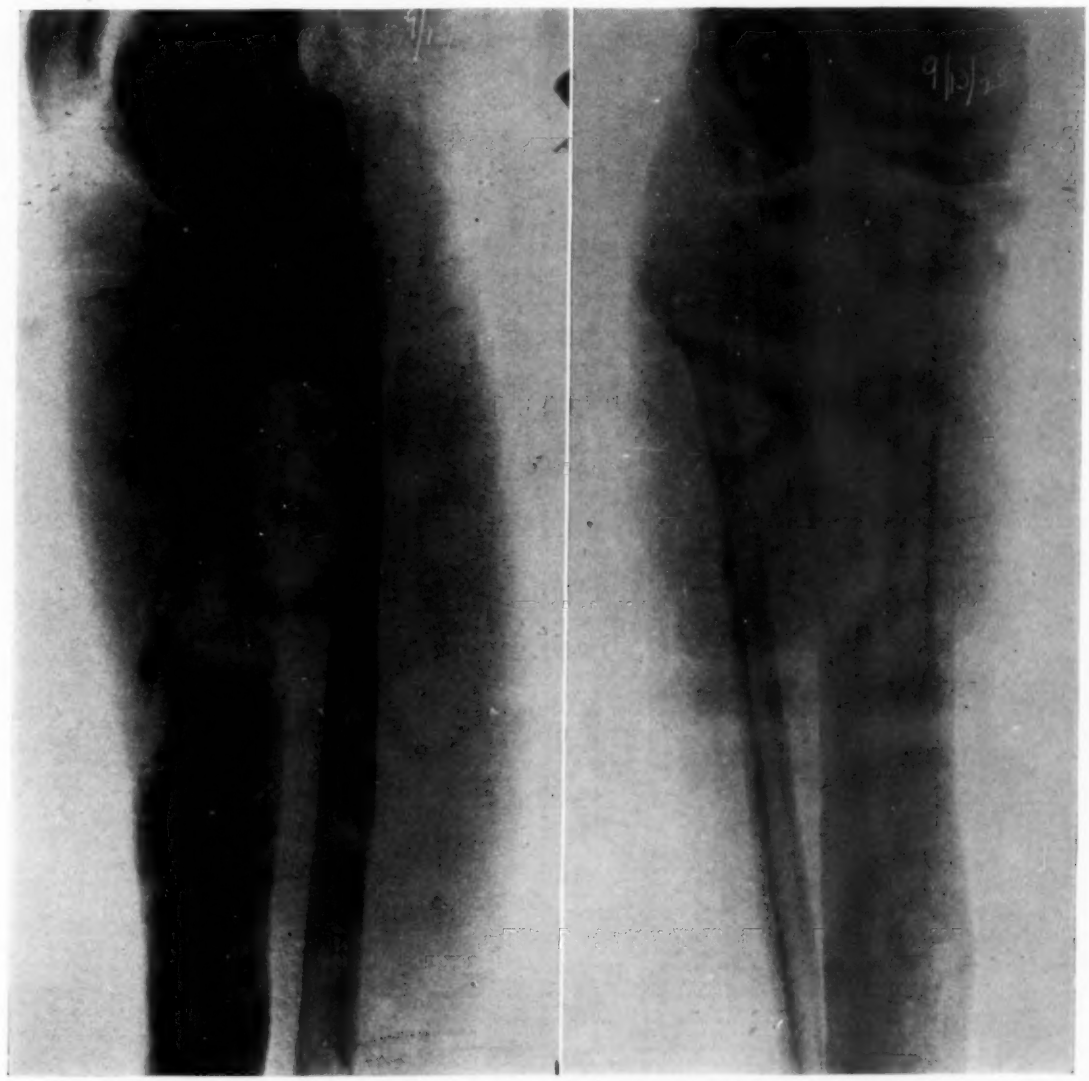


Fig. 3. September 13, 1925, shows rapid extension of the process with pathologic fracture; and now the evidence in favor of a neoplasm is unmistakable. The picture is quite characteristic of the endothelial myeloma type (described by Dr. Ewing).

circumference of the stump was 19 inches.

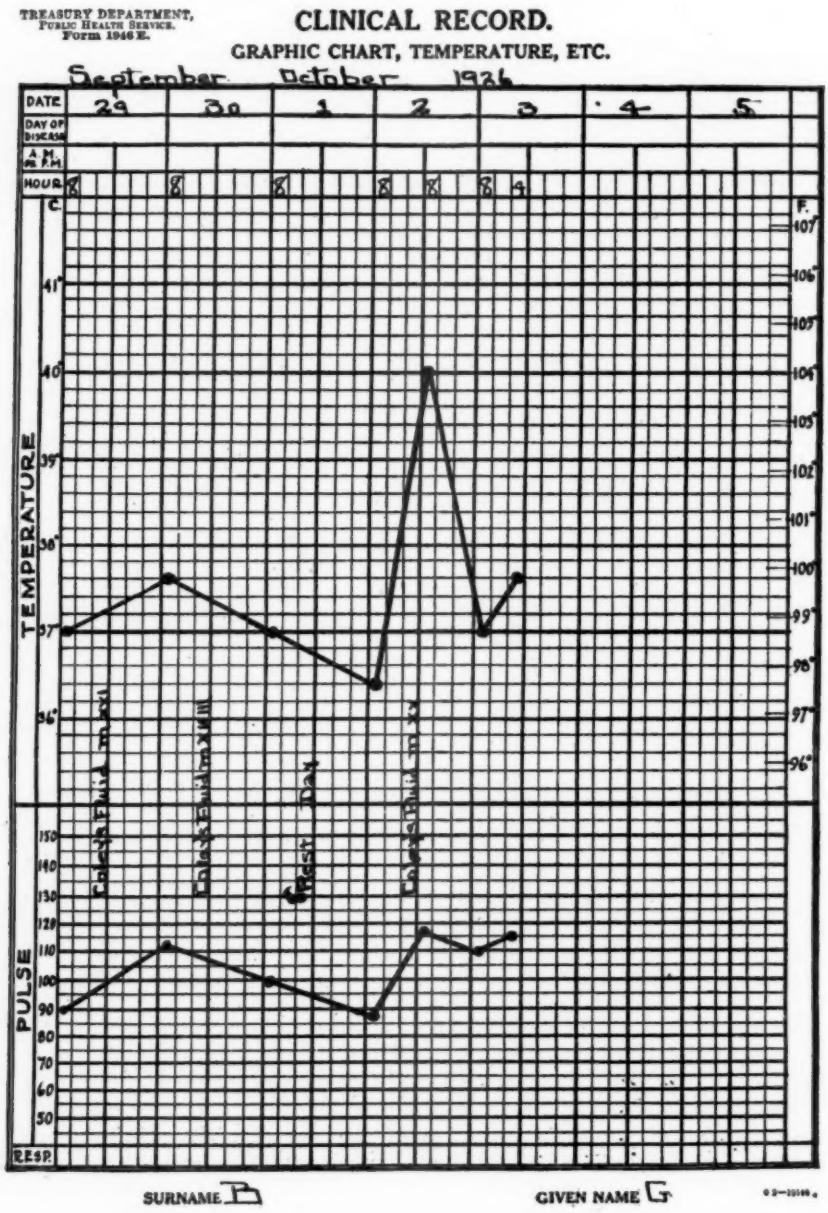
Injections of Coley's toxins were begun, the dose ¼ of one minim. This dosage was increased ½ minim daily until the patient was receiving 6½ minims. Temperature reactions following injections were

groin had disappeared. The supraumbilical mass was decidedly smaller, softer and lighter in color. The patient looked paler no doubt due to severe reactions following injections. His weight was 117¾ pounds. The injections were held at 6½ minims from January 25 to February 2, 1926, when

they were increased 1 minim a day until the patient was receiving 18 minims daily. On February 20 they were discontinued because of extreme weakness of the patient. At this time the stump had taken on new growth, associated with considerable edema of both good leg and stump.

On March 17 there were three small vesicles on the end of the stump. The supraumbilical growth had increased considerably in size and was now the size of a large lemon. On March 27 two minims of Coley's toxins were injected directly into the tumor mass on the stump. The dosage was gradually increased each day until April 7, at which time he was receiving five minims directly into the tumor. Each injection was followed by considerable temperature reaction. Figure 7 taken February 23, 1926, shows the stump of the femur undergoing dissolution. There is hardly a skeleton of the cortex seen with the bony substance, primarily the calcium, disseminated into the soft structures in all

CHART A

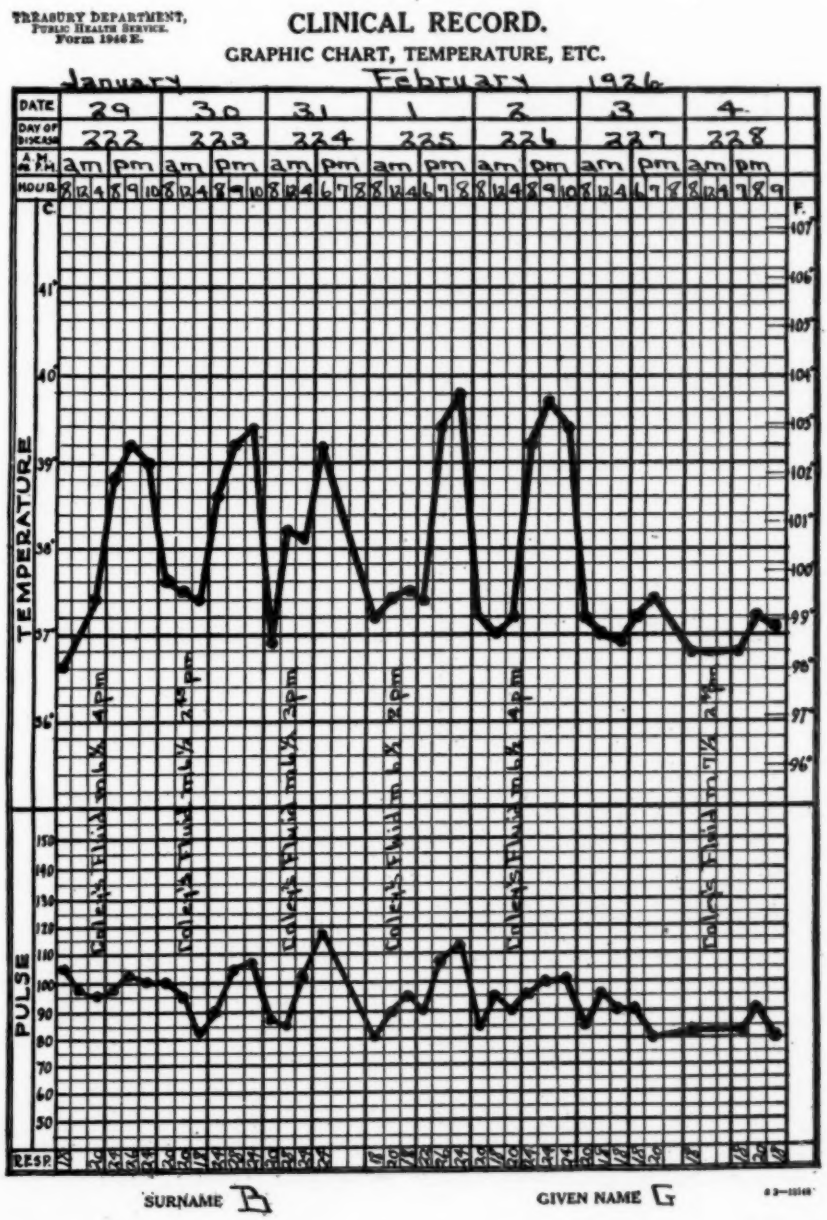


directions, as if transported by the lymphatics and veins.

On May 5, 1926, several small nodules were felt under the skin of the abdomen. During May and June the patient grew steadily worse with metastatic growths appearing in many parts of the body, among which was considerable involvement of the right clavicle and multiple tumors in the scalp, cranial bones, and cervical vertebrae.

About this time the maximum growth of the tumor in the stump was attained, the circumference of which was 31 inches. The end of the stump had broken down over an area about 5 inches in diameter, from which there was a foul, profuse, ichorous discharge.

Chart B



On August 5, 1926, Coley's fluid was again begun with a dosage of two minims and increased a minim a day until he was receiving 17 minims at a dose. The dose was held at this point until September 4. By this time improvement was marked; edema of the good leg and the stump had

decreased very much and the stump had almost healed. The supraumbilical mass had practically disappeared; areas of involvement of the scalp had disappeared, the clavicular tumor had decreased considerably in size.

An additional series of injections was begun September 19 and continued for three weeks.

On November 22, the general condition

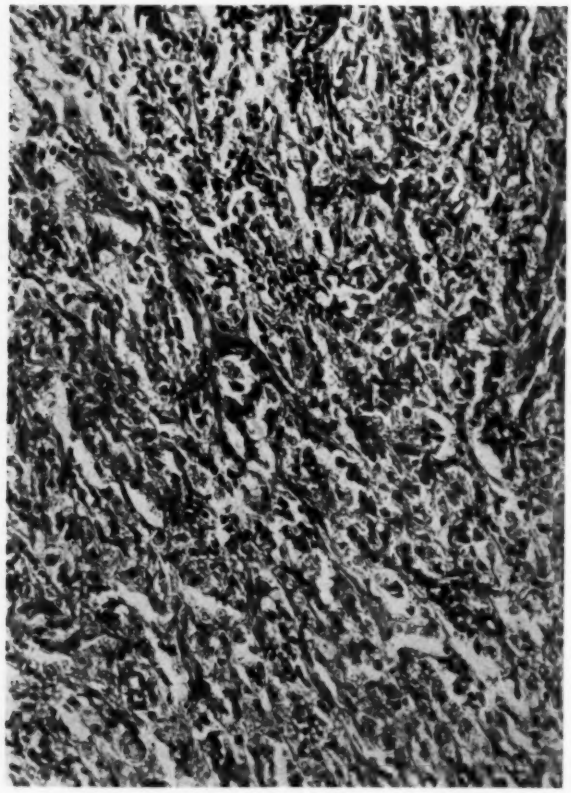


Fig. 4. Microphotograph of specimen of bone removed at exploratory operation on Sept. 11, 1925.

of the patient was excellent, weight being 147 pounds. The stump was 17 inches in circumference, a reduction from 31 inches in May. The old discharging wound of the stump was entirely healed, the skin quite leathery and underlying it was a tough fibrous mass believed to be scar tissue. Growths on the abdomen had disappeared. Just above the umbilicus there was an area of pigmentation of the skin which was 3½ inches long by 2½ inches wide and corresponded to the site of the former tumor. Areas of involvement in the scalp and skull could no longer be discerned. There was still present some degree of thickening and roughening of the right clavicle.

The pathological diagnosis of sarcoma was concurred in by Drs. Ewing Taylor, James Ewing, and E. A. Codman. The roentgenological diagnosis was made by Dr. Frank Liberson.

The patient was discharged from the

Fig. 5. Stump of femur on Nov. 25 or sixty days after amputation. No evidence of recurrence.

hospital apparently recovered, December 5, 1926.

At our suggestion the patient returned to the hospital February 13, 1927, for further treatment. Every third day he was given injections of Coley's toxins, beginning with 3 minims and the amount doubled each time, until 30 minims were given at a time. He was discharged March 27, 1927, in good condition.

He again returned to the hospital, according to suggestion, from October 23, to December 7, 1927, and was given Coley's toxins every third day up to 30 minims.

The patient was last examined January 9, 1928, at which time there was no evidence of disease present. There still remained as evidence of former disease, scarring, discoloration and slight thickening of skin over stump and abdomen (in

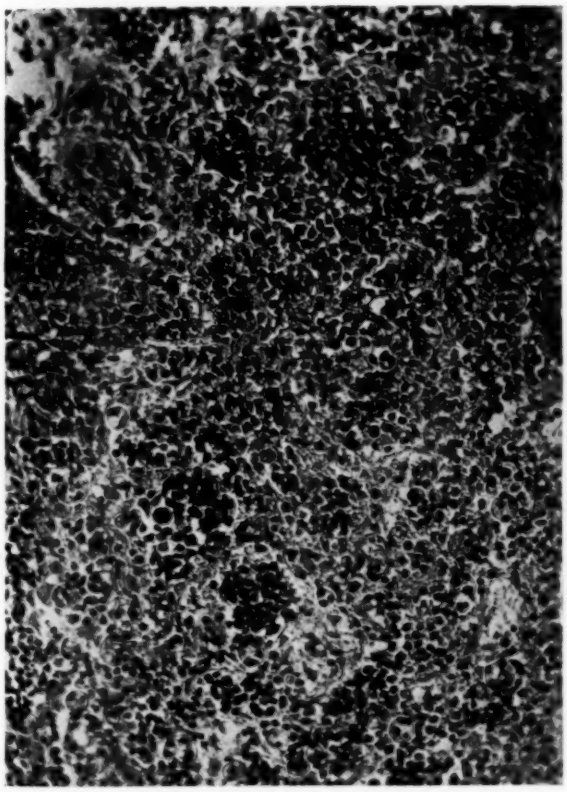


Fig. 6. Microphotograph of section from a metastatic tumor beneath the skin just above the umbilicus, removed on Dec. 12, 1926. Diagnosis: myelosarcoma, metastatic.

Fig. 7. Feb. 23, 1926, shows very extensive recurrence in stump and femur, with marked destruction or dissolution of bone extending nearly to the trochanter.

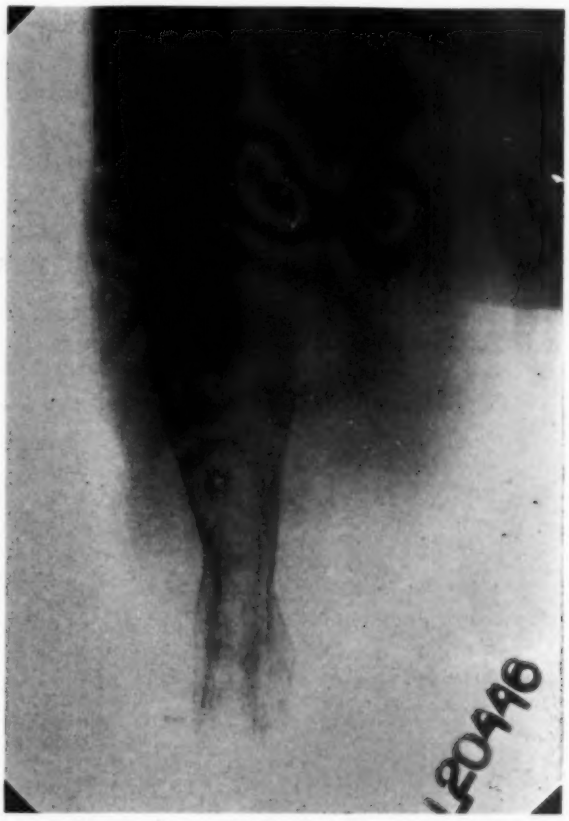


Fig. 8. Shows the condition of the femur and stump at present, Jan. 8, 1928, two years after the beginning of the toxin treatment and fourteen months after the disappearance of the metastatic tumors. Shows the marked new bone formation replacing the bone destroyed by the tumor.

areas corresponding to former tumors) and slight thickening and roughening of the right clavicle, all of which appeared to be scar tissue and was essentially the same as conditions above reported November 22, 1926. His weight was 143 pounds.

Figure 8, taken January 9, 1928, shows the appearance of the stump at the present time. The photograph of the patient was taken January 9, 1928. (Fig. 10.)

On December 1, 1927, the patient was presented at the clinical conference at the Memorial Hospital, New York. The discussion at this conference by Dr. Coley follows:

COMMENTARY BY DR. WILLIAM B. COLEY OF NEW YORK

I am greatly indebted to Dr. Christian and Dr. Palmer for permitting me to present their patient at the staff-conference

of the Memorial Hospital on December 1, 1927. At this time the patient was apparently in the best of health; he had gained more than forty pounds in weight; and careful examination failed to reveal any evidence of the numerous metastatic tumors that were present in the bones and soft parts when the toxin treatment was

Fig. 9. Condition on Jan. 8, 1928, or two years after beginning toxin treatment. Stump entirely normal; and roentgenogram shows no evidence of disease.

begun. More than a year has elapsed since the last follow-note was made in the original report.[1]

I believe this is one of the most remarkable cases of malignant tumor of the long bones that has ever been published, and I am quite willing to admit that, had the patient been under my care, he would probably not be alive today. In the first place, I am almost certain that I should not have continued the treatment after three months when not only no improvement had been noticed but marked increase had taken place in the metastatic tumors and especially in the recurrent tumor of the stump (an increase of from 17 to 31 inches). In the second place, I am quite sure that

Fig. 10 showing condition of patient on Jan. 8, 1928, two years after beginning treatment and fourteen months after disappearance of multiple metastatic sarcoma of stump of femur, skull, clavicle and soft parts of various regions.

I should not have dared to increase the dose to such a large amount (30 minims). However, it was not until these large daily doses were given that the improvement was noted, which improvement continued until all the tumors had disappeared. I have learned more from this one case than from any other that I personally have treated, and I feel that many of the past failures might have resulted otherwise had larger doses and more frequent injections of the toxins been given.

In view of the roentgenogram findings, the microphotograph and the type of multiple metastases that involved both bones and soft parts, I believe we are warranted in placing this case in the group of endothelioma or endothelial myeloma (so fully described by Dr. Ewing).

This case of Dr. Christian and Dr. Palmer together with the remarkable case of Dr. Howard Lilienthal, presented at the meeting of the New York Surgical Society in December, 1926,[2] prove that it is possible to cause the complete disappearance of a far-advanced inoperable sarcoma with extensive multiple metastases, by systematic injections of the mixed toxins of erysipelas and Bacillus prodigiosus, without radiation or any other form of treatment.

While too short a time has elapsed in the first case to permit it being classed as a "cure," Dr. Lilienthal's patient is well now three and two-third years since the treatment was begun. This case is almost as remarkable as the one under discussion. While Dr. Lilienthal describes it as an inoperable mediastinal tumor, on exploratory operation he found extensive involvement of the ribs and spine; and from these findings, as well as the clinical history, I am inclined to believe it to be, more probably, a primary sarcoma of the spine and ribs with secondary metastasis in the mediastinal glands. At any rate, the child had a large, inoperable tumor of the mediastinum with involvement of the ribs and spine, resulting in complete paraplegia. At the time the treatment was begun, the case was regarded as entirely hopeless by every surgeon who had seen it. Under a very short course of toxin treatment covering a period of three weeks during which only eleven injections were given, the child made a complete recovery and is well at the present time. In this case, no radiation or other form of treatment but the toxins was given.

It is very fortunate that in both of these cases the diagnosis was confirmed by a number of eminent pathologists, including Dr. James Ewing.

I believe that these two cases, published within a few months of each other, furnish sufficient answer to the criticism often made in the earlier years and not infrequently in recent years that other surgeons have been unable to obtain the same results from the method (toxin treatment) as I have. Those who are interested in the results obtained in various types of bone sarcoma, are referred to my paper recently published in the *Archives of Surgery*.[3]

REFERENCES

1. Christian, S. L. Apparent recovery from multiple sarcoma. *Mil. Surgeon*, 1927, lxi, 42–47.
2. Transactions, New York Surgical Society, *Ann. Surg.*, 1927, lxxxv, 615.
3. Coley, W. B. and B. L. Primary malignant tumors of long bones; end-results in 170 operable cases. *Arch. Surg.*, 1927, xiv, 63–141.

SURGICAL CLINICS
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VALUES OF PHYSICAL THERAPY IN THE CLINIC*

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FROM a haphazard and empirical form of treatment, physical therapy has gradually emerged within the past ten years, to take its place as a valuable and rational adjuvant to the usual medical and surgical methods. Mankind has apparently always appreciated the values of light and heat as pain-relieving and tonic agencies; but since within a generation intensive study has been accorded them the rational and scientific reasons for their administration are becoming known. The spectrum has been divided into its component parts, the wave lengths have been measured, the physiologic action of each has been studied, and the shorter wave lengths of the upper spectrum have begun to be utilized, and science has gone beyond into the angstrom units of ultraviolet rays. At the other end of the spectrum are the long, heating wave lengths of the infra-red. These supposedly more penetrating rays are utilized for their relief of pain and effect on circulation. By the agency of convective heat, peripheral circulation is increased and the acceleration of the blood stream promoted, thus facilitating the process of repair of injured and diseased tissue, as well as increasing the resolution and elimination of inflammatory products. The bactericidal effects of heat and light are well known, and in physical therapy are found effective weapons for combating disease, and hastening the process of repair.

The more penetrating forms of heat, generated by means of the high-frequency current, are called conversive; the resistance of the tissues to the passage of the high voltage, low amperage and rapidly oscillating current generates within the tissues the deep-seated heat known as diathermy. Medically it is used to heat tissues, superficially or deeply, within physiologic limits; surgically the current in the active electrode may be so concentrated that destructive effects are produced. This is called surgical diathermy; it has a well-defined place in many forms of surgery. The removal of accessible neoplasms, benign or malignant, is quickly and safely brought about by the desiccating current. Blood and lymphatic vessels are sealed in the process, and metastasis from malignant areas is much less likely to occur.

Massage, active and passive exercise, and hydrotherapy all have their indications in many painful and diseased conditions. These methods, however, must be employed with intelligence and caution, the underlying pathologic condition always being taken into consideration. Massage is a pain-relieving agent; it stimulates circulation, promotes absorption, relieves stasis, cleanses the skin, and has an action

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on peripheral as well as deep-seated nerves. Its action on muscles is profound; warmth is promoted, and increased nutrition of the muscle substance is brought about, and this without nervous expenditure on the part of the patient. Hence, in weakened and debilitated conditions, convalescence is much hastened. Massage is really a form of passive exercise, and although it does not take the place of active exercise, it fills a need in a large group of cases.

The physical therapy in cases of fractures has been one of the outstanding methods in modern surgical practice, and is certainly radically different from the methods of even a generation ago. In the older methods of treatment a fractured member was placed in splints or casts for six or eight weeks, and neighboring joints were kept immovable; this was always followed by serious loss of function, and many additional weeks were required for the restoration of the atrophied muscles and ankylosed joints. By careful application physical therapy for many fractures may be begun within a week of the initial accident, or even sooner. Utmost care, of course, is necessary; but gentle massage, the application of radiant or infra-red heat, diathermy, and careful active exercises may all be practiced with good results. Thus along with the repair process of the bone, function in joints and muscles is increased concomitantly, and convalescence is much shortened and the chances of complete recovery are greatly improved. In recent fractures, when bony union is just begun, passive exercise should not be instituted. When exercise is indicated it should always be the active form; that is, the patient should be encouraged to attempt movement of his own volition, hence he will always stop short of damage or pain. Those movements which he can do with little or no pain are generally valuable in keeping up the tone of the muscles and in preventing adhesions in tendons and joints. Excessive passive motion, by the hands of an operator, should be avoided in recent cases.

Among painful inflammatory conditions which are benefited by radiant heat and light and diathermy are (1) myositis; heat and massage seem especially indicated; (2) synovitis and bursitis; diathermy, with the electrodes placed as nearly as possible on opposite sides of a limb, is a valuable form of treatment; it should continue for from twenty to forty minutes; (3) orchitis and epididymitis; diathermy with the Corbus scrotal electrode seems to give marked relief in most cases; the treatment may last forty minutes, and be given two or more times a day; (4) arthritis; the traumatic type seems to respond more readily than the chronic type of hypertrophic arthritis; but even in the latter, improvement results if possible foci of infection are removed. Relief from pain and greater mobility of joints usually follow after a course of diathermy.

Sprains respond well to radiant heat and light and diathermy, followed by massage. Fixation by adhesive strapping may be necessary for a brief period, but should not be too long applied. Active exercise and movement short of excessive pain should be begun early, to prevent uncomfortable fibrous adhesions around the joint. If there is extensive hematoma in deep contusions, heat with light massage is preferable to diathermy in the early stages. Diathermy is of value in the later treatment, and seems to be conducive to the absorption of blood clots and reduction of inflammatory changes. If it is instituted too soon, hemorrhage may be increased. In the old cases, massage may be more vigorous.

The ultraviolet rays from the mercury arc are of decided value in the treatment of many dermatologic conditions. In acne the initial dose should be such as to produce decided erythema, with subsequent exfoliation. In many cases the results are remarkable. Conditions of herpes zoster respond well to ultraviolet irradiation. Indolent ulcers and infected areas are improved by the application of the rays from the water-cooled lamp. Care should be taken in cases of recent granulation to avoid destruction

by overdose. General body irradiation has apparently a very tonic effect, increasing and fixing the calcium and phosphorous content of the blood. Hence in case of rickets and tetany ultraviolet light treatment seems almost specific. Radiation from the sun and artificial sources seems especially beneficial in so-called surgical tuberculosis, especially in tuberculosis of bones, glands, and peritoneum.

It is impossible in a short paper to emphasize all the forms of physical therapy which find their places in any clinic. It is unnecessary to stress the importance of careful diagnosis and knowledge of the physiologic effects of the various physical agencies. We know, of course, that none of the methods is panacea, but simply a means of assisting nature in the processes of repair. These agencies must be used carefully and discriminatingly, and physical treatment should be under the direction of a medical man who has made special study of the methods employed. The Council on Physical Therapy, appointed by the American Medical Association, is doing a splendid work in separating the wheat from the chaff, and the result of its work will be, no doubt, that physical therapy will be placed on a rational and scientific basis. This is a "consummation devoutly to be wished."

SOME REMARKS ON THE PREOPERATIVE, OPERATIVE AND POSTOPERATIVE TREATMENT OF BENIGN PROSTATIC HYPERTROPHY*

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MUCH has been written during the past few years on prostatic hypertrophy. All its phases have been discussed, so that I propose to discuss briefly some of the factors in the surgical management of benign prostatic hypertrophy which have produced very gratifying results, with special emphasis on some of the fundamental principles.

MORTALITY

The urologist in coöperation with the internist and physiologic chemist has according to Young[5] succeeded in lowering the general mortality of prostatectomy from 20 per cent twenty years ago to 2 or 3 per cent today, the most striking result I believe that has been shown in any branch of medicine or surgery. Many authors during recent years have reported large series of cases with few deaths. Young[6] reported 198 cases with one death, Davis a series of 107 cases with only one death. Such results can be obtained only by the strictest attention to details in the management of these cases and by coöperation with other specialists.

PREOPERATIVE TREATMENT

Preoperative treatment and rest in selected cases for two or three days prior to the operation if it is to be done by the two-stage suprapubic method or even prior to the institution of catheter drainage, afford time for a thorough study of the cardiovascular and renal systems. The internist is called on to give an opinion as to the patient's general condition; particular attention is given to focal infections so that they may be eradicated before any operative procedure is carried out. Most of these patients are usually partially dehydrated on presenting themselves so that the institution of bladder drainage whether by suprapubic cystotomy or catheter must be done with great care as dehydration may be easily carried beyond the stage of repair in spite of the administration of water by any method.

Fluids should be forced and here again it is the internist who decides how much fluid the myocardium can tolerate. The myocardium should be watched carefully and digitalis in sufficient dosage administered when indicated. Patients with hypertension stand the operation well but patients with low blood pressure should be carefully watched; they often have myocardial defects and chronic focal infection elsewhere than in the genitourinary tract. These patients easily become anuric. Forced fluids and the administration of $\frac{1}{30}$ grain strychnin sulphate three times daily together with digitalis are usually productive of good results. The patients generally are put on a low purin diet and in addition those with hypertension if it is producing symptoms are given a salt-free diet.

URINARY ANTISEPTICS

Some form of urinary antiseptic is usually administered; if the urine on admission is alkaline, 1.5 grains acriflavin (Boots) twice daily for five or six days

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followed by 10 grains each of urotropin and sodium acid phosphate four times a day are generally the most satisfactory. The patient who on presenting himself has a moderate or large amount of residual urine with only a few pus cells should be carefully watched since infection is so likely to follow any operative procedure. The urine in these cases usually contains a Gram-positive coccus so that the use of hexylresorcinal is of value.

If marked cystitis is present the irrigation of the bladder twice daily with hot tonic solution of sodium chlorid or potassium permanganate followed by the institution of 1.0 per cent mercurochrome or 10 per cent argyrol renders the bladder more tolerant to the suprapubic drain and in many instances to the indwelling catheter.

In spite of everything, however, we all see occasionally a case of unexplained bladder spasm following the institution of drainage. This distressing complication has been known to overtax the patient's resistance so that death results.

METHOD OF OPERATION

The choice of the method employed depends on the operator's experience and the selection of cases. Equally good results are obtained in both the perineal and the suprapubic methods. Hunt in discussing the choice of operation states: "An unprejudiced analysis of the ultimate functional results and mortality rate following both methods of operation by those experienced in them, shows that these indexes of merit can no longer be utilized to discredit one or the other method."

My experience has been limited almost entirely to the suprapubic method; the mortality has been low and the functional results have been good. It is not within the scope of this paper to discuss when a one-stage or two-stage operation should be employed. That is a point which must be answered in each individual case; generalization cannot here be applied.

ANESTHETIC

The choice of the anesthetic agent employed is of vital importance to the patient. Since with this class of patients the cardiovascular-renal systems are practically always impaired in varying degrees, it follows that any anesthetic agent which produces further impairment of renal function cannot with safety be employed. Laboratory experiments and clinical experience have taught that ether impairs renal function so that its use by urologists in prostatic surgery has been practically abandoned. Caudal and sacral block anesthesia are suitable for perineal operations, but they must be supplemented by abdominal block for the suprapubic cases. In the hands of most men who have employed this type of anesthesia excellent results have been obtained. My experience with spinal anesthesia has been limited. In the few cases in which it was employed the results were excellent. Anuria and grave cerebral complications I believe are likely to accompany the drop in blood pressure which occurs with spinal anesthesia. Since it has been shown, notably by Ockerblad and Dillon, that ephedrin can be satisfactorily employed to combat the changes in blood pressure during spinal anesthesia I believe that with the proper evaluation of the technic in its employment spinal anesthesia will soon find a permanent place in prostatic surgery.

Personal observations extending over a four-year period on the use of nitrous oxid and oxygen, and during recent years on ethylene gas, lead me to believe that these are in most instances the anesthetics of choice. I have never observed any untoward results from their use and consider them reliable and safe anesthetic agents when properly administered.

Local anesthesia of the infiltration type usually suffices in most cases of suprapubic cystotomy. In the very fat, the short fat, and the nervous and apprehensive persons nitrous oxid and oxygen is a more practical type of anesthetic. It has been shown

beyond question that psychic shock is a factor in the production of surgical shock. If a patient who is to have suprapubic cystotomy is extremely nervous and apprehensive I believe in employing gas anesthesia from the start rather than to begin the operation with local anesthesia and then resorting to gas. The psychic shock I am sure is less and the operation is carried through from beginning to completion without interruption.

Recent experiments and reports by Cabot and Ransom show that the effect of ethylene gas on renal function is minimal, no more probably, than the effect of the operation itself regardless of the anesthetic employed. It produces sufficient relaxation of the abdominal muscles, therefore its only objectionable features would be the occasional severe postoperative nausea which I have noted and the technical difficulties in its administration; the latter, however, have been overcome in most hospitals. One of the greatest objections to nitrous oxid-oxygen anesthesia has been that there is insufficient relaxation; if sufficient relaxation for the proper performance of the operation cannot be obtained with nitrous oxid and oxygen anesthesia, ethylene is employed; this simply means the substitution of one gas for the other.

DRAINAGE

Drainage is to be considered as one of the most important factors in the management of these cases. It should be adequate and complete. If drainage is to be done by means of the indwelling catheter one of the types of catheter especially devised for this purpose should be used since adequate and comfortable drainage cannot be obtained with the ordinary type of rubber catheter.

For drainage by suprapubic cystotomy the Pezzer types of tube are suitable. I prefer the angle type to the straight. Kinking and the dragging sensation of which the patient sometimes complains do not occur. For those cases in which cystitis is marked and a great deal of mucus is present the angle, double Pezzer tube is most satisfactory. Thorough irrigation of the bladder can be accomplished with little discomfort to the patient. I believe it is unnecessary to use a tube larger than a No. 38 French. Ample drainage with smaller tubes can be obtained and there is not the softening and necrosis of the tissues of the abdominal wall surrounding the tube. In using these tubes leakage is reduced to a minimum. The patient remains dry and comfortable. Because leakage is reduced to a minimum, dependable phenolsulphonephthalein functional tests can be carried out. The opening in the bladder should always be made as high as possible; this greatly facilitates closure of the fistula. Gentleness should be exercised in pushing back the peritoneal fold from the surface of the bladder. The degree of postoperative distention is to a great extent dependent on the gentleness with which this fold is pushed back from the bladder. If much distention occurs and is not relieved by enemas, physostigmin hypodermically in full doses is employed. If the patient's blood pressure is low, pituitrin is used; this raises the blood pressure and aids in renal secretion.

It is, of course, a well-known fact that blood chemistry studies on these patients show a retention of nitrogenous products in varying degrees. With the institution of bladder drainage, the retention of these products gradually diminishes and the phenolsulphonephthalein output gradually increases. Drainage should be continued until the patient's condition becomes stabilized and in my experience it requires an average of from ten to fourteen days. Drainage should be of long enough duration to allow for a return of bladder function. The greatly distended bladders and distended ureters must be allowed to regain their tone. Pyelitis is often the result of improper preparation of the bladder before prostatectomy.

If aversion to water develops during the preoperative and drainage periods the

patient is provided with glucose sugar candy; this furnishes readily oxidizable sugar and produces thirst.

HEMOSTASIS

Complete hemostasis of the suprapubic wound at the time of operation renders infection less likely. A small cigarette drain should be inserted into the space of Retzius. This drain should be gently inserted so that the bladder is not separated from its anterior attachments; this would leave a pocket as a trap for infection. Closure of the fascia with interrupted sutures of No. 2 chromic catgut permits the patient to be up and around on the second or third day without fear of herniation.

Hemostasis at the time of enucleation of the prostate is the second most important factor in the management of these cases. Complete hemostasis is secured first, by exercising gentleness and care in the enucleation and, secondly, by the use of some mechanical measure.

The Hagner and Pilcher bags are useful mechanical devices, but I prefer the gauze pack. The gauze is soaked in glycerin and packed tightly into the gland cavity; the pack is removed fractionally during the next twelve or twenty-four hours. I have never seen alarming hemorrhage following the use of the pack. The pack, of course, causes the patient some discomfort, producing a more or less constant desire to void. This annoying symptom is easily controlled by dram doses of tincture of hyoscyamus every three hours, or if this does not suffice, morphin in small doses.

If a bag is to be used I favor the one designed by Barry. After deflation it can be left in place without causing any more discomfort than an indwelling catheter. If bleeding occurs the bag can be reinflated. It is withdrawn through the urethra and not through the suprapubic incision as are the other bags. The materials necessary for its construction are always at hand: a 24 F catheter and a piece of thin rubber tubing such as is used for making a cigarette drain.

A single, angle Pezzer tube is inserted into the bladder after the pack is removed and as the wound closes, smaller tubes are inserted; the patient is kept dry. Bladder irrigation is commenced about the fourth or fifth day. At this time the clots begin to separate and the bladder is kept much cleaner. The use of the indwelling catheter to facilitate closure of the sinus and to provide better drainage following prostatectomy is a rational procedure. Irrigation of the bladder through the catheter followed by the instillation of mercurochrome aids in preventing infection. The indwelling catheter must be inserted and handled with care as in my experience epididymitis is more likely to follow its use than in those cases in which it is not employed.

EPIDIDYMITIS

Epididymitis occurs frequently as a troublesome complication and in most cases it greatly retards convalescence. I have never seen a fatality and in only one instance suppuration. However, it is a formidable complication and every means should be taken to prevent it. It may occur before operation, following repeated catheterization; it may occur after operation or several weeks postoperatively. In the first instance it is the patient who has been leading a catheter life who presents himself with this complication. Active treatment as support, ice bags, and the intramuscular injection of foreign protein usually suffices. Sodium iodid and urotropin intravenously gives marked relief in some cases.

Double ligation and section of the vasa preoperatively have in the hands of some reduced the incidence of this complication from an average of 20 to 4 per cent. This is a relatively simple procedure and I believe it should be recommended to all patients who are to undergo prostatectomy.

SUMMARY

Management of surgical prostatic cases during the past few years as it has been

practiced by urologists has resulted in lowering the mortality comparable with that for many operations which are performed on younger and stronger persons. Since the average age of patients in the usual group that comes for prostatectomy is seventy years, and the average mortality is 3 per cent, I feel that this major operation can be unhesitatingly recommended as a safe procedure.

Adequate bladder drainage and complete hemostasis are to be considered as the two chief factors contributing to this low mortality.

BIBLIOGRAPHY

1. Cabot, H., and Ransom, H. K. Ethylene as an anaesthetic for general surgery. *Ann. Surg.*, 1927, lxxxvi, 255–259.
2. Davis, E. Perineal prostatectomy under sacral anesthesia. One hundred and seven consecutive cases with one death. *J. A. M. A.*, 1927, lxxxviii, 784–786.
3. Hunt, V. C. Treatment of the surgical patient handicapped by urinary obstruction. *Surg., Gynec. & Obst.*, 1926, xlii, 187–190.
4. Ockerblad, N. F., and Dillon, T. G. The use of ephedrine in spinal anesthesia. Preliminary report. *J. A. M. A.*, 1927, lxxxviii, 1135–1136.
5. Young, H. H. The technic of prostatectomy and its relation to mortality. Report of one hundred and sixty-five consecutive cases of perineal prostatectomy without a death. *J. A. M. A.*, 1922, lxxviii, 933–940.
6. Young, H. H. Prostatectomy: pre-operative, operative, and postoperative treatment. *Surg., Gynec. & Obst.*, 1923, xxxvi, 589–609.

PRESENT STATUS OF KNOWLEDGE OF THE FUNCTIONAL TESTS OF THE LIVER*

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GRADUALLY one after another as the result of clinical and laboratory research, various organs of the body are emerging from a position of obscurity. Previous conceptions are necessarily being altered, teachings which have passed unchallenged for decades are being revised as a result of the rising tide of investigation into the intricacies of the diseases of man. Nowhere does this apply more than to that varifunctioning organ, the liver, closely allied as it is functionally to every other organ in the abdomen. In spite of its most important and complex rôle, the functional clarification of the liver in both health and disease has been extremely slow. Facts of one kind and another are just now beginning to be unraveled and fitted in here and there wherever they may belong until gradually a more understandable and workable concept of the liver is being evolved. The goal is still distant, however, although the achievements of many in as many different fields have developed a close relationship to each other and have been the means of establishing a basis for further progress. How true it is that many of the present-day procedures are revisions or modifications of methods conceived in years past. So too some of the present means of investigation, interesting though shorn of any great usefulness, may become of utmost importance when linked with future possibilities.

A slight resumé of the many functions of the liver may make for a better understanding of the various tests which are at the command of the investigator. Metabolism of sugar is one of the functions in which the hepatic cell plays a part; the cell converts sugar to glycogen and stores it as such and then as occasion arises the glycogen is redistributed to the body as sugar. Mann[8] has shown clearly that following removal of the liver in the dog there is marked and progressive decrease in the sugar of the blood, explainable on the possible grounds that hepatectomy produces depletion in the carbohydrate material of the body either directly by removal of the store of carbohydrate and its plan of elaboration or indirectly by removal of a substance which has to do with carbohydrate utilization. He has also shown that the decreasing blood sugar and concomitant symptoms following such a procedure can be combated by injections of glucose. Clinically, however, even in cases with marked and destructive hepatic disease it is rare to find hypoglycemia.

The formation of urea from amino-acid nitrogen is conducted by the liver, as demonstrated by Mann.[4] In the dehepatized animal no measurable amount of urea is formed.

The liver has a rôle in the metabolism of cholesterin, fat, and iron and in the production of fibrinogen. It is a great detoxicating organ.

The last important function of the hepatic cell has to do with bilirubin: its reception, formation, and excretion. This pigment is derived from hemoglobin with hematin as an intermediary product and is found normally in the blood serum of man in small amounts.

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BILIRUBIN AND ITS FORMATION

Mann has demonstrated that most of the bilirubin is manufactured by the reticulo-endothelial cells especially of the bone marrow. Although bilirubin is made in the liver and spleen the amount is insignificant as compared with that made in the bone marrow. However, there is more bilirubin in the spleen than in the liver, but it can be formed at its normal rate in the experimental animal in the absence of these two organs.

Mann has also shown that following dehepatization in the dog, jaundice occurs, which would clearly indicate that the pigment was formed elsewhere than in the liver, and that the liver acts primarily as an excretory organ for bilirubin, and only secondarily and to a small degree as a formative organ.

There has been a diversity of opinion regarding the similarity or dissimilarity of the bilirubin of obstructive jaundice and of hemolytic jaundice. Van den Bergh believed that they were essentially different according to his experience with the Ehrlich diazo reaction. This reaction is direct in obstructive jaundice and indirect in hemolytic jaundice; in other words, the bilirubin in the blood before it reaches the liver will not give the typical color on the addition of the reagent but requires the addition of alcohol before this color is produced (indirect reaction). If on the other hand the same bilirubin after it has passed through the hepatic cell and is reabsorbed into the blood gives a direct reaction, the typical color appears as soon as the reagent is added. The pigment is apparently altered in its passage through the hepatic cell.

Magath and Sheard in their experiments showed that the spectral analysis of serum obtained from essentially normal persons and of that from persons with jaundice from various causes are alike. While it is evident from the van den Bergh reaction that the bilirubins vary, possibly in their physical states, the substance is essentially the same whether from an obstruction or a hemolytic cause, and the common source is the erythrocytes. Hemorrhage in the body is associated with an increase in serum bilirubin. Magath and Sheard showed that as far as spectrophotometric determination is concerned the bilirubin of normal persons and of those suffering from malaria, pernicious anemia, hemolytic icterus, or jaundice due to common duct obstruction are the same.

Any process resulting in too rapid destruction of blood or too slow excretion of bile results in retention of bilirubin. In hemolytic jaundice the erythrocytes are more fragile than normal and hence they are more readily broken down, which explains the jaundice. In malaria the increased amount of bilirubin in the blood is due to the rapid mechanical rupture of the erythrocytes.

By means of the spectrophotometer it is possible not only to identify bilirubin as such but also to measure it in smaller quantities than has previously been possible by any calorimetric method.

Another phase of the absorption of bilirubin and its excretion by the liver has been brought out by Mann[5] in states of biliary duct obstruction. Following the occlusion in the common duct the pressure within the ducts is increased. When this pressure reaches a certain level the hepatic cell becomes impervious to bilirubin so that bile pigment is neither excreted into the bile capillaries nor is it absorbed from the blood by the hepatic cell. When this condition occurs the jaundice is similar to that following complete removal of the liver; the pigment formed in the bone marrow is held in the circulatory blood, some is absorbed by the tissues, and some is excreted in the urine.

If this be true we must alter the explanation of the direct van den Bergh reaction in obstructive jaundice. The direct van den Bergh reaction in this type of jaundice is supposedly due to changes in the bilirubin as it passes through the hepatic cell. If the hepatic cell under such circumstances is unable to absorb bilirubin from

the blood, the change cannot take place in this way.

The difference between the bilirubin giving a direct, and that giving an indirect reaction, is that in the latter the bilirubin is combined with the serum protein or lipoids so that it does not react with the van den Bergh reagent until this linkage has been broken by the addition of alcohol. The direct reaction of obstructive jaundice may be due to retention in the blood of a substance which destroys the union of the bilirubin with the serum and allows it to react in a direct manner. This inability of the hepatic cell to absorb bilirubin in obstructive jaundice has a bearing on the phenoltetrachlorphthalein test of liver function and cholecystography in this condition.

Excessive pigment in the blood may arise from one of two causes: (1) Production of bilirubin in the marrow and spleen may exceed the ability of the liver to remove it from the blood, and the pigment accumulates in the serum. In this case the van den Bergh reaction is indirect. (2) Because of obstruction in the extrahepatic ducts or of disease of the hepatic cell itself either the bile is dammed back and escapes into the blood or, as was previously mentioned, the hepatic cell no longer is able to remove the pigment from the blood. Here the van den Bergh reaction is direct. In either case there occurs a time when the bilirubin in the blood is present in an amount exceeding the normal yet not enough to discolor the skin, sclera, or urine. As this accumulation increases a point is reached at which these phenomena appear. It is evident, therefore, that hyperbilirubinemia may occur without manifest jaundice, a state which is known as latent icterus. The demonstration of latent icterus furnishes a means of differentiating diseases which in some respects have certain factors in common. An increase of bilirubin in the blood in the presence of anemia would suggest a hemolytic rather than a secondary type of anemia especially that associated with carcinoma. In cases of hemolytic jaundice and pernicious anemia, changes in the serum bilirubin serve to indicate changes in the severity of the hemolytic process.

An increase of serum bilirubin associated with an indirect diazo reaction is characteristic of icterus of hemolytic origin and is diagnostically valuable.

The icterus index (a test for retention of bilirubin) is dependent on the comparison of the color of the serum with a standard potassium bichromate solution. This test, however, is not devoid of error, as other substances especially the vegetable pigment, carotin, may impart a yellowish color to the serum. The van den Bergh method of measuring the quantity of pigment in the circulatory blood is not only more accurate but also distinguishes qualitatively the type of bilirubin present.

In obstructive jaundice the bilirubin curve is of appreciable help to the surgeon; an upward curve indicates increased attendant danger of hemorrhage, when operation should be avoided, and on a downward curve the surgeon may choose the most advantageous time for operation.

The estimated pigment in the blood is a more accurate criterion of the progress of jaundice than the degree of staining of the skin and sclera, as the pigment content of the plasma returns to normal sooner than the color disappears from the tissues.

During acute attacks of cholecystitis latent icterus is frequently present, and may be of diagnostic importance. In chronic cholecystitis it is normal. An elevation of the bilirubin level in the blood can be expected whenever hemorrhage takes place in an organ or cavity or in infarction. It may be of aid in determining definitely the presence of a ruptured ectopic pregnancy or hemorrhage from a ruptured viscus.

LIMITATIONS OF THE DYE TEST

The endeavor to evolve a test which would be indicative of the function of the liver as a whole seems futile since the hepatic functions are many and varied and more or less independent of one another.

The disturbance or cessation of one function is consistent with normalcy in the other. Too, the large reserve of the organ is a hindrance to a study of the details of hepatic deficiency. Mann has shown that it is possible to remove at one time without any deleterious effect on the animal as much as two-thirds of the organ.

Tests of liver function with pigment (phenoltetrachlorphthalein, bromsulphthalein) are associated with significant error since excretion of the pigment takes place with the secretion of the bile and for this reason is dependent on production and secretion of bile. We are thus far not in a position to decide in each type of manifest icterus to what extent the change of bile flow as such or the disturbance of function of the liver cells affect the retardation of excretion. This has definite significance for the test of hepatic function especially for the clinician for he must forego in this manner any kind of differential diagnosis regarding the individual cases of icterus. It may be seen, therefore, that the retention of dye is always to be found in the first place and in the highest degree in pronounced icterus of whatever nature it may be. Hence the dye test in cases of definite icterus expresses really no more than the icterus itself; in latent icterus, in beginning as well as in subsiding catarrhal icterus, and corresponding cholelithiasis, the dye test expresses no more than the latent icterus itself.

The test in the majority of instances can establish only what clinical examination teaches, corroborated by the diazo reaction (van den Bergh test) in the blood, and other tests which are to be mentioned. There is no further clue for the differential diagnosis and often not even for the existence of hepatic changes. If for instance there is prolonged dye retention in the serum in a nonicteric case with or without ascites with definite pathologic but diagnostically obscure liver findings there still is no clue from the dye test whether for instance it is a case of cirrhosis, carcinoma, obstruction in the liver, or fatty liver. It is for this reason that there is expression in the literature of only the expectation that these tests will in the future explain a very few cases, especially those in which damage is due to lues and latent salvarsan injury. Another exception may be mentioned; after complete disappearance of jaundice and the return of the serum bilirubin level to normal there frequently is a persistent slight degree of dye retention that apparently indicates the degree of residual hepatic disturbance in consequence of the jaundice. Metastasis in the liver from known carcinoma elsewhere, without jaundice is sometimes revealed by dye retention. When this occurs it is significant but frequently metastasis occurs with normal dye excretion.

On the basis of physical examination and with the aid of other functional tests the clinician may with a high degree of certainty diagnose hepatic disease and functional disturbance as such; he is especially interested in progress in the field of differential diagnostic methods. But the dye tests, however much they deserve theoretic interest and however much they may represent a practical aid in cholecystography, have added little as regards a liver function test and especially differential diagnosis.

GALACTOSE TEST

Two tests which are being used quite extensively in Europe, especially in Vienna, seem to be of aid in differentiating the types of jaundice: the galactose test[2] and Ehrlich's aldehyde reaction. For the galactose test 40 gm. of pure galactose is given in the morning on an empty stomach. The bladder is emptied preceding the ingestion of the sugar. The urine is collected every hour for four hours or until a specimen contains no sugar. The entire amount of urine is then examined quantitatively for sugar according to the method for the quantitative estimation of glucose in urine. The excretion after 40 gm. of galactose is as follows: 1 gm. and less,

normal; from 2 to 3 gm., doubtful; 3 gm. and more, positive.

According to Bauer[2] the test is negative in all cases of mechanical icterus whether it is manifest or latent. It is positive only when the icterus is the expression, or secondary symptom, of true disturbance of the function of the hepatic cell as for instance in catarrhal icterus, cirrhosis of the liver (both types), or subacute and acute atrophy of the liver. In this manner he gained the knowledge that the hepatic cell becomes severely damaged by transitory mechanical icterus only in the rarest cases and that a final injury of the hepatic cells occurs only rarely.

In the galactose test there are not only possibilities for differential diagnosis but also direct knowledge of the pathology of icterus. In the non-icteric cases, in those already mentioned in which latent icterus comes into consideration, the galactose test is likewise independent of these relations. It shows here only the functional disturbance of the hepatic cell itself. Thus for instance Bauer finds the galactose test positive quite regularly in cases of hepatic cirrhosis especially in the pre-ascitic stage, regardless of whether the patient has latent icterus, manifest icterus, or no icterus. In localized disease of the liver as gumma, or benign and malignant tumor, the galactose test remains negative or at least normal because here the hepatic function is scarcely disturbed. In cases of acute and subacute liver atrophy and salvarsan icterus there are also positive values which are parallel with the condition or with the variation in its course.

In cases of ascitic cirrhosis the amount of the total excretion suffers from decreased resorption and delayed oliguric excretion. Here the duration of the sugar excretion which may last for from four to twenty-four hours, as well as the high sugar content of the small amount of urine are in themselves pathognomonic. In secondary lues, disturbances of hepatic function are demonstrable by the galactose test and for this reason this test should be used in doubtful cases preceding salvarsan treatment.[3]

EHRLICH'S ALDEHYD REACTION

Bile pigment in the intestinal tract is changed to urobilin and urobilinogen and this is excreted in the feces. Some, however, is reabsorbed into the portal circulation and taken to the liver to be changed and excreted in the bile. As long as the liver is normal little if any escapes into the general circulation to appear in the urine, although traces sometimes appear in the urine of normal persons.

If there is disturbance in the liver, urobilin and urobilinogen escape into the hepatic veins and so into the general circulation and appear in the urine in large amounts as detected by Ehrlich's aldehyd reaction. The qualitative test consists of adding 1 c.c. of Ehrlich's aldehyd reagent (2 gm. paradimethylaminobenzaldehyd dissolved in 100 c.c. of a 20-per cent solution of hydrochloric acid) to 4 or 5 c.c. of urine. If urobilin is present a red color appears immediately. The dilution in which urobilin is present can be estimated spectroscopically. The amount and not simply the fact that the reaction is positive is most important. This aldehyd reaction serves a purpose not so much as regards hepatic disease in general but as regards the judgment of icterus in particular. The aldehyd curves of urine, especially in comparison with the bilirubin curves are according to the Viennese school almost pathognomonic for the individual forms of icterus.

The fact that urobilin is formed from bile pigment in the intestinal tract is valuable in differentiating mechanical obstructive jaundice and hepatogenic jaundice. In obstructive jaundice with complete block such as occurs in carcinoma of the head of the pancreas, no bile reaches the intestine; consequently no urobilin can be formed and the aldehyd reaction in the urine will be negative. In jaundice due to parenchymatous hepatic disease such as catarrhal jaundice or the cirrhoses of the liver, bile is never completely absent from the intestine and urobilin appears in the urine in large amounts.

In a given hepatic disease, as is almost

always true in cases of icterus, the aldehyd reaction is directly opposed to the degree of icterus. The first consequence of disturbance in the liver is a positive aldehyd reaction. In every type of jaundice whatever the cause the aldehyd reaction will at first be positive. It will be positive before the onset of jaundice; as the jaundice increases the aldehyd reaction decreases and finally becomes negative in the presence of total obstruction of bile. On the day the patient has bile in the urine and a negative aldehyd reaction the jaundice and obstruction are complete no bile escaping into the bowel. A negative aldehyd reaction in a person long jaundiced would suggest malignant or total obstruction of the common duct. If after from four to five weeks the reaction became positive the malignant condition would be ruled out.

In cases of cirrhosis of the liver, and catarrhal jaundice, the aldehyd reaction is positive. Metastatic carcinoma in the liver according to Bauer will give a positive aldehyd reaction. This would be of inestimable value to the surgeon in deciding as to the operability in case of certain malignant conditions. If then in abdominal carcinoma the aldehyd reaction is negative metastasis of the liver would be ruled out.

Lues because of a toxic influence weakens the liver; in other words, it predisposes the liver to other affections. If in a person with lues, catarrhal jaundice develops it may last for months. If a luetic patient (without jaundice) has a marked aldehyd reaction and positive galactose test, the hepatic condition should be improved before salvarsan is given; this will reduce the danger of producing atrophy of the liver.

The aldehyd reaction is positive in malaria, and it is marked in the presence of hemorrhage anywhere in the body. The same is true of infarction. In case of infarction of the lung there may be no hemoptysis; however, a positive aldehyd reaction can usually be obtained. The aldehyd curve in case of obstruction of the common duct by stone seldom shows a permanently negative aldehyd reaction; in daily multiple examinations one repeatedly finds a flare-up of the reaction; the obstruction by a stone is rarely continuously complete. Obstructive jaundice by stone, in the absence of cholangeitis, may persist several months without necessarily damaging the liver. At times it is not complete and a little bile escapes so that the strain on the liver is not as marked as it would be were the obstruction always complete and constant. The liver soon recovers when the obstruction is relieved.

The aldehyd curve of catarrhal jaundice is an interesting one. Early in the disease the test is definitely positive; after two or three weeks it may be completely negative for a short time, and then rise rapidly while the bile pigment in the urine decreases; it becomes more marked when the urine is free from bile pigment and after the jaundice subsides the curve may vary and gradually become negative. This curve shows clearly the course of the jaundice, and shows that in catarrhal icterus there is a stage of complete obstruction of bile. For some weeks after the jaundice of catarrhal icterus has subsided the diazo reaction and galactose test may still be positive. These findings demonstrate that catarrhal jaundice is not as harmless as is believed.

Bauer[1] has shown that histologic examination of the liver in catarrhal jaundice gives findings which indicate quite specifically that at the peak of this disease there are principally the same changes as in acute atrophy of the liver. Since the alimentary galactosuria which remains negative in mechanical icterus and circumscribed hepatic disease, is positive in precisely such diseases as acute and subacute liver atrophy, phosphorous liver, hepatic cirrhosis, and catarrhal icterus, Bauer has, because of the similarity of these functional findings, suggested an anatomic resemblance in these latter processes.

FORMS OF HEPATIC JAUNDICE

The old term, catarrhal jaundice, is somewhat of a misnomer. The condition is not caused by a catarrhal condition of the

ducts nor duodenitis but is a definite affecton of the hepatic cell itself. European physicians chose rather to call it simple jaundice or hepatosis. Catarrhal jaundice may develop into hepatic cirrhosis. Since the anatomic picture of catarrhal icterus resembles that of acute liver atrophy it may lead to subacute liver atrophy.

The interesting picture of subacute liver atrophy has been known since 1919. Everyone saw such clinical pictures before that time but was unable to interpret them. Some fever, varying icterus, pain in abdomen, sometimes ascites, a varying tedious course are the principal characteristics of the disease usually diagnosed as catarrhal icterus, cholangeitis, cholelithiasis or inflammation of the portal vein. The disease is not as rare as one would expect. I recently had a case in which the presence of subacute atrophy of the liver was suspected and was confirmed at necropsy.

In subacute atrophy of the liver, the liver and spleen may remain enlarged. The liver is nodular and the condition may be mistaken for carcinoma or lues. Such patients may have recurrence of symptoms off and on, sometimes after a year's interval. I have observed one such case.

In this disease group may be mentioned also cases of so-called luetic icterus and salvarsan icterus. As regards luetic icterus Bauer has assumed on the basis of the galactose findings that, like catarrhal jaundice, it is a toxic parenchymatous icterus. Salvarsan jaundice is apparently produced on the one hand by luetic toxins, on the other hand by salvarsan damage to the liver. Salvarsan icterus especially may show the clinical picture of subacute liver atrophy or change into this disease. If a patient has catarrhal jaundice which does not disappear in the usual length of time, lues should be suspected.

To prevent salvarsan icterus in luetic patients who show a weakened liver by positive aldehyd and galactose tests they should be filled with sugar, as the liver requires sugar in the detoxification of many substances.

The difficult question of hepatic cirrhosis, especially the classification, is of special interest here from the standpoint of icterus. In portal or atrophic cirrhosis significant icterus may be observed which may be so marked at times that it suggests carcinomatous icterus. This may be true as long as the liver is still large. In portal cirrhosis a preceding stage with large liver can be observed.

Cases of so-called Hanot's cirrhosis are extremely rare. On the other hand there are forms of hepatic cirrhosis in which splenomegaly and jaundice are the chief symptoms but instead of a large smooth liver there is a granular liver. Improvement or cure may follow splenectomy in these cases.

Non-obstructive biliary cirrhosis is rarely met with. The type of the disease most frequently seen is that due to obstruction and infection of the ducts.

European physicians believe that biliary cirrhosis from retention of bile in obstruction of the common duct is rare; their evidence is quite convincing. They have the opportunity of observing their cases over a long period of time. The material is abundant and necropsies are done routinely.

Judd and Counseller believe that in obstruction of the common duct biliary cirrhosis may or may not occur. This depends on the type of obstruction and the presence or absence of infection. Stones in the common duct and in the gallbladder are frequently associated with infection in the wall of the gallbladder and of the ducts. The obstruction from stone is rarely constantly complete; intermittently bile escapes into the intestine, relieves the pressure and allows the ducts and liver to recover somewhat from the effects of biliary stasis. The associated chronic cholangeitis ascends to the finest bile ducts and hepatic acini producing the perilobular type of fibrosis and proliferation of ducts, typical of obstructive biliary cirrhosis. Because in this type of occlusion the obstruction is intermittent, according to these authors, dilatation of the biliary

tree is not excessive which accounts for the absence of hydrohepatosis. They believe that stricture of the common duct with resultant obstruction which is seen mainly following operation on the biliary tract, is not due to injury inflicted at the time of operation but to obliterative cholangeitis. Fibrosis of the ducts and portal spaces is marked producing a severe grade of obstructive biliary cirrhosis.

Malignant obstruction which is almost always due to carcinoma of the head of the pancreas is complete resulting in a marked degree of dilatation of the biliary tree or hydrohepatosis. Here infection is absent or is only a terminal event, and biliary cirrhosis rarely occurs. There must be infection in addition to obstruction to cause such cirrhosis.

The European investigators may be correct in their observations that biliary cirrhosis rarely occurs in obstruction of the common duct, but this is probably only when there is absence of infection.

Judd and Counseller state that Courvoisier's law is entirely applicable to the whole biliary system as it is to the gallbladder and common duct, and that the condition of the gallbladder may be taken as an index of the condition of the biliary system in general. If it is small, fibrotic and contracted on stones, the ducts themselves are probably not particularly dilated following obstruction of the common duct although it may be surmised that they are the seat of more or less marked chronic cholangeitis. If the gallbladder is dilated, thin-walled, and free from stones, as occurs in carcinomatous obstruction at the head of the pancreas, the extrahepatic biliary tree is also probably tremendously dilated but free from infection.

Another disputed question is that of Banti's disease, which is thought to begin with anemia and splenomegaly (first stage), later leading to cirrhosis of the liver (second stage) and ascites (third stage). Characteristic cases of Banti's disease are rarely seen in this country or in Europe with the exception of those countries bordering on the Mediterranean Sea. It is more likely that we must assume that some cases of hemolytic jaundice or yellow cirrhosis as well as cases of thrombosis of the splenic and portal veins or occasional splenic tuberculosis or neoplasm are diagnosed as Banti's disease.

The usefulness of cholecystography in the diagnosis of pathologic conditions of the gallbladder needs no further mention here. It must be remembered, however, that the dye is taken up by the hepatic cell and excreted in the bile; consequently in the presence of jaundice with the hepatic cell incapacitated the excretion of the dye can no longer occur. If jaundice then is present, no information concerning the gallbladder can be obtained by cholecystography.

So, after all, our knowledge of the liver, its functions in the normal state and its varied reactions to disease is not as meager as that of a few years ago. Further investigation will undoubtedly substantiate present views and conceptions that the liver plays one of the most prominent and conspicuous rôles in the metabolism of the body.

BIBLIOGRAPHY

1. Bauer, R. Das Ikterusproblem in der Klinik. *Wien. klin. Wchnschr.*, 1927, xl, 1–16.
2. Bauer, R. Personal communication.
3. Bauer, R., and Nyiri, W. Welche Ziele verfolgt der Kliniker mit der Leberfunktionsprüfung? *Klin. Wchnschr.*, 1926, v, 1833–1837.
4. Bollman, J. L., Mann, F. C., and Magath, T. B. Studies on the physiology of the liver. xv. Effect of total removal of the liver on deaminization. *J. Physiol.*, 1926, lxxviii, 258–269.
5. Bollmann, J. L., Sheard, C., and Mann, F. C. An experimental study of obstructive jaundice, with particular reference to the initial bilirubinemia. *Am. J. Physiol.*, 1927, lxxxi, 461–468.
6. Judd, E. S., and Counseller, V. S. The effects of obstructive lesions of the common duct of the liver. *J. A. M. A.*, 1927, lxxxix, 1751–1756.
7. Magath, T. B., and Sheard, C. Spectrophotometric analysis of blood serum in normal and pathologic conditions. Study i. *Arch. Int. Med.*, 1927, xxxiv, 214–225.
8. Mann, F. C., and Magath, T. B. Studies on the physiology of the liver. iv. The effect of total removal of the liver after pancreatectomy upon the blood sugar level *Arch. Int. Med.*, 1923, xxxi, 797–806.

CASE REPORTS

ACUTE CELLULITIS OF THE HYPOPHARYNX AND NECK WITH EXTENSION TO THE MEDIASTINUM

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DETROIT

WE are here presenting the case. of a young married woman, thirty years of age, admitted on the general surgical service March 15, 1927. Her past history gave no evidence of sore throats or frequent colds, and her family history was unessential.

Her present illness dates from March 11. Four days previous to admission the patient had had a slight sore throat; twenty-four hours later she noticed extreme difficulty in swallowing, and even talking caused considerable pain. There was swelling and tenderness in the right side of the neck. On the following two days she was unable to take anything by mouth on account of the pain in the right side of the neck. She had used iodine over the neck in the region of swelling with no relief, and also an argyrol spray and silver nitrate applications to the throat. The patient had noted some enlargement of the neck for the past several years, but no symptoms of thyroid disease. There was a history of pregnancy of five months' duration but the patient's general health had been very good until the onset of the present illness.

On physical examination, at admission, the patient was acutely ill. The temperature was 100.2°, the pulse 118. She was unable to talk above a whisper. There was rather marked swelling of the right side of the neck extending from below the jaw to the right clavicle. This was extremely tender but no induration and no evidence of fluctuation were made out. All of the cervical glands of the right side were slightly enlarged. We were unable to palpate the right lobe of the thyroid on account of the acute tenderness. The left lobe of the thyroid was moderately enlarged. There was definite exophthalmos. The pharynx was rather injected, the tonsils small, cryptic and injected. The chest was clear to percussion and auscultation and examination of the heart showed a slight enlargement with a systolic murmur which was transmitted to the axilla.

Examination of the abdomen showed a symmetrical midline tumor, which extended to within two finger breadths of the umbilicus. There was no abdominal tenderness or rigidity.

Dr. Garretson saw the patient and found considerable edema of the epiglottis and was suspicious of an abscess on the right side. There was marked tenderness of the larynx. Dr. Garretson advised steam inhalations and ice compresses to the neck, and further observation of the patient. Fluids were forced by proctoclysis, hypodermoclysis and intravenous injections.

Laboratory reports on admission showed W.B.C., 52,000, polymorphonuclears, 97 per cent. Culture of the throat showed hemolytic streptococcus and smears taken from the throat showed numerous chains of streptococci, with a few fusiform bacilli and spirilla. A blood culture taken that day was negative, and the Wassermann was also negative. The following day, March 16, 1927, the patient's temperature was 103, her pulse 130 and her condition apparently very much worse.

She was taken to the operating room,

and under local anesthesia Dr. Garretson incised a small abscess at the base of the epiglottis. Following this the patient was much more comfortable and was able to take some fluids by mouth. Tenderness and swelling of the right side of the neck, however, had increased, with some swelling of the left side as well. No fluctuation, however, was noted and the mass showed little induration.

Towards evening her condition began to grow worse, with increasing respiratory difficulty and rising temperature. She was taken to the operating room and Dr. McGraw made an incision along the anterior border of the right sternomastoid muscle down to the thyroid gland, with the hope of finding pus. She took the anesthetic very poorly and because of the respiratory difficulty a tracheotomy had to be done. A small amount of purulent bloody serum was encountered under the surface of the sternothyroid muscle and about the thyroid gland. Drains were placed in the wound. Cultures from this wound revealed a hemolytic streptococcus. The patient spent a somewhat better night, but on the following day her temperature remained up and her pulse was around 140 or 150 per minute. She was complaining of considerable substernal pain and was very tender on pressure over the sternum. Many fine moist râles were heard over the mediastinal region. The chest was otherwise clear to percussion and auscultation. The fluid intake was kept up by means of hypodermoclysis and intravenous therapy.

A blood culture was taken three days after admission and was reported positive for hemolytic streptococcus. On the morning of the third day the patient began to have some pelvic pain with a slight discharge of blood. About three o'clock in the afternoon the patient's pain increased in severity, and on examination the head of a fetus was found in the vagina; shortly afterward she expelled a male fetus of 26 cm. in length. The placenta was expelled intact ten minutes later and no hemorrhage followed. During the abortion the pulse was as high as 170 per minute and was extremely feeble. Following this she was transfused with 650 c.c. of citrated blood with no adverse reaction. Her condition continued to grow worse, the temperature remaining high and pulse extremely rapid, but the patient had very little respiratory difficulty with the tracheotomy tube. The respirations were, however, somewhat irregular and the patient distinctly stuporous, but she could be aroused easily and could make known her wants.

The following day she was again transfused and was given 20 c.c. of 1 per cent aqueous mercurochrome solution intravenously. There was no reaction from this and no changes in the pulse or temperature were noted. She was also given 10 c.c. of a special concentrated polyvalent antistreptococcus serum which was sent from a local pharmaceutical company. She continued, however, to grow worse and became very cyanotic, with a very feeble pulse; considerable abdominal distension and tenderness over the lower abdomen developed, and she died at four in the morning of March 20, five days after admission.

Diagnoses were made of: septicemia, hemolytic streptococcus; acute mediastinitis; cellulitis of the neck; and abscess of the larynx.

DISCUSSION

Dr. Garretson: I saw this patient the day after she was admitted to the hospital. The case impressed me, as it did Dr. McGraw and the rest of the men who saw her, as a very serious one. Laryngeal examination showed an abscess of the epiglottis and intense edema of the pyriform sinus and posterior wall of the pharynx. There was no definite bulging of the pharynx, just a brawny induration. The next morning the edema and infiltration were even more marked and we drained the abscess of the epiglottis and made an incision laterally, but did not think there was any definite localization in the region of the hypopharynx. I saw the autopsy and was impressed with the retroesophageal inflammation at the base of the hypopharynx.

In drainage of retropharyngeal abscesses in the region of the hypopharynx it is much better, if there is no diffuse cellulitis of the neck, to make an incision along the anterior border of the sternomastoid, then to retract it posteriorly and separate the visceral from the vascular fascial sheath. This permits entry into the hypopharyngeal region. There are no important structures passing between the visceral and the vascular sheath in the region from the level of the greater cornu of the hyoid bone above to the level of the cricoid cartilage below. In this so-called "neutral zone," the two sheaths can be separated; externally, the internal carotid and the common carotid and internal jugular vein; internally, the esophagus, pharynx and larynx. Median incision over the trachea will not drain this region.

I have drained several abscesses in this region by this method, to avoid upper respiratory tract infection and also cellulitis of the neck. In this case, even though we assumed that there was a retropharyngeal abscess, we did not feel that it could be drained because of diffuse cellulitis throughout a llplanes of the neck. It is much better to use local anesthesia, as very frequently in general anesthesia the patient will develop edema of the larynx and tracheotomy will have to be resorted to.

Some years ago I had a case in Edinburgh with retropharyngeal abscess in the hypopharynx. The patient could not swallow and also developed intense edema of the larynx. At my suggestion, the abscess was drained by the method just described and the patient could swallow fluids almost immediately afterward, and made an uneventful recovery. If we had had to resort to tracheotomy, pneumonia in all probability would have developed.

Dr. McGraw: I can recall perhaps a half-dozen cases of severe infections in the cervical region. Of these I remember three which proved to be deep cervical abscesses with a considerable accumulation of pus. Two of them were acute with all the evidence of an intense inflammatory reaction; the third was a rather chronic affair with edema only and a certain amount of brawny induration to suggest an underlying abscess. Two other cases that I recall seeing through their course in the hospital were more of the type of the case that is being presented today; that is, an acute fulminating perilaryngeal and periesophageal infection with a tendency to spread down the fascial planes of the neck, causing a mediastinitis. The second of these cases came into St. Luke's Hospital, New York, with symptoms somewhat like the present patient's, but not as acute. The edema and tenderness, and swelling of the tissues of the neck tended to be symmetrical and a little lower than one would expect for a true Ludwig's angina. This man was seen three or four times by Dr. Downes, who refused to make an incision in the infected area. The man was placed in a steam tent, watched very carefully, and in the course of four or five days began to improve; eventually he made a good recovery without our ever being able to make out any localized focus of infection. The other case was of a woman some ten years older than the present patient, who was brought into the same hospital one evening, with the same history of painful swelling of the tissues of the neck, following a sore throat of rapid onset. She presented the same picture as our patient of today, a rather diffuse edema and tenderness of the neck, a little more tender on one side than on the other. This case was opened up under local anesthesia, and the incision carried down beneath the sternothyroid muscle and also higher up in the neck to a point beneath the mylohyoid muscle and into the capsule of the submaxillary gland. In her case there was no pus found at all, simply a large amount of thin serous exudate. The organism was the same, a hemolytic streptococcus. Tracheotomy had to be done the following morning, and she died within forty-eight hours after entering the hospital.

Dr. Hartman's report of the postmortem examination: The patient was a rather slight woman, 160 cm. in length. The skin was rather firm except for the marked rigidity of the back, chest, face and neck. The striking thing was the cervical incision in the neck, extending from the level of the larynx to the suprasternal notch, through which the thyroid gland presented. The base of this wound was covered by a thick yellow exudate and the thyroid was surrounded by similar exudate. The chest was rather long and narrow, but symmetrical. On opening the body, thick yellow pus spurted from the abdominal incision. The peritoneal surface was rough and covered by fibrin. The pelvis and flanks were filled with this same type of rather thick yellow exudate, a surprising type of extravasation for a streptococcic infection. The loops of bowel and the other organs were all surrounded by this exudate. The diaphragm was quite low, extending to the 5th rib on the

right and to the 5th interspace on the left. On opening the thorax, the left side contained 1000 c.c. of turbid fluid in which flakes of fibrin floated. The right side showed 1500 c.c. of the same type of fluid—in fact, the fluid flowed from both cavities as soon as the incision was made.

There were no fibrous adhesions on either side, but the lower lobe of each lung was completely collapsed against the diaphragm. The pericardium contained about 300 c.c. of fluid, but the pericardial surfaces were smooth. The right side of the heart was markedly dilated, especially the ventricle, and the tricuspid ring measured 12 cm. contracted, with the mitral measuring 8 cm., showing the disproportion between the two sides. The valves were intact but the heart muscle was gray, even necrotic in places. The largest area of necrosis was 1 cm. in diameter, and was in the wall of the left ventricle. Surrounding the necrotic area there was considerable congestion. The mediastinum showed small abscesses in the upper portion and this same type of thick yellow pus exuded when the sternum was separated from the mediastinal tissue. The infiltration extended down and around the great vessels and over the arch of the aorta. The neck organs and arch of the aorta were removed en masse, and when the pharynx was severed above the larynx there was a good deal of exudate infiltrating the fascial planes; this was seen to extend along the fascial planes covering the vertebrae down into the mediastinum, entirely surrounding the esophagus and trachea down to the bifurcation of the trachea. The upper fascial planes were not so extensively infiltrated and there were no abscesses nor any infection of the thyroid gland proper. On section it was grayish red in color and semitranslucent.

Returning to the chest, the lymph glands were all enlarged but none showed suppuration. The lungs were about the usual size, the left weighing 400 and the right 500 gms. The upper lobes were both air-containing and edematous, but the lower lobe on both sides and part of the middle lobe on the right were entirely collapsed. Bits of this tissue dropped in water sank at once.

The abdominal cavity showed little except the extensive fibrino-purulent peritonitis. The spleen and liver were of usual size. The liver and kidney on section were gray and granular, having the grayish granular cooked appearance of parenchymatous degeneration. The uterus was considerably enlarged, measuring 20 by 15 by 12 cm., and its walls were 2 cm. in thickness. The lining endometrium was gray and necrotic, with considerable hemorrhage in the walls. In each broad ligament there was thickening and adhesions, but not of a recent process. Each ovary contained small cysts and this cyst fluid was purulent. The tubes were patent, but contained no exudate.

Diagnoses were made of: history of streptococcus sore throat, retropharyngeal abscess, hemolytic streptococcus septicemia, hemolytic streptococcus peritonitis, cellulitis of neck, mediastinitis. Postoperative wound for tracheotomy and drainage of cervical cellulitis; acute fibrino-purulent pleurisy, bilateral; partial atelectasis, lower lobe of both lungs; diffuse necrotic myocarditis. Postpartum uterus with acute endometritis and metritis; chronic salpingo-oophoritis, bilateral, with acute infection of ovarian cysts; chronic cholecystitis, perihepatitis and perisplenitis.

LYMPHOSARCOMA: PRIMARY IN THE INGUINAL GLANDS

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DETROIT

THE patient to be studied is a married white man, aged fifty-seven, a retired farmer by trade. He first entered the diagnostic clinic of the Henry Ford Hospital on February 21, 1927, with the chief and only complaint of a swelling in the right groin of some three years' duration. Venereal infection was denied. There was no family history of neoplasm or tuberculosis. His general health throughout the course since his entrance complaint had been good.

Three years ago he noticed the appearance of a painless non-tender lump beneath the skin of the right groin, a little smaller than a walnut in size. This grew gradually larger until it reached a size of three times its original dimensions, but it was never tender, nor was the overlying skin swollen or red. There were no associated systemic symptoms and no medical advice was sought or treatment instituted. After growing in this way over a period of two years, the size of the lump began last summer to recede until it once more was no larger than a walnut. Beginning this fall, however, increase in size again commenced, progressed more rapidly, and recently produced slight local discomfort. The swollen mass reached somewhat larger dimensions than its previous greatest size, but again no effort was made either towards diagnosis or therapy.

Physically the patient was a stockily built, rather sallow middle-aged man, 5 ft. 1½ in. in height, 152 lbs. in weight, slightly obese and of fair muscular development. Temperature, pulse and respiration were normal, blood pressure 140/90. His reflexes were O.K. General examination of heart, lungs, abdomen, extremities, genitalia and rectum revealed nothing unusual, except as will presently be noted. Special examination of eyes, ears, nose and throat showed moderate ametropia and deflection of nasal septum, with spur formation.

In the right inguinal region there could be seen an elevation of the skin, rather irregular in contour, indistinct in outline, and showing over a small area perhaps 2 by 3 cm. a slight dusky redness of the skin. Palpation of this swelling did not cause pain nor was there any sensation of temperature elevation, pulsation or thrill detected. Palpation further confirmed the irregularity and indistinctness of outline. It was uniformly firm and toughly elastic in consistency. It did not give the impression of an intra-abdominal mass, but rather of lying in the abdominal wall. The mass was immovable over the deeper tissues, and apparently fixed to the skin also. The slightly reddened area of skin, before referred to, was not fluctuant. On investigation in the left inguinal, both femoral, both cervical and both axillary regions, there was no enlargement of lymph glands detected, discretely or in groups.

Laboratory studies done on the patient were as follows: Hemoglobin 15.3 grams, white blood count 5600 to 6400; differential, polymorphnuclears 66, eosinophiles 4, small mononuclears 17, large mononuclears 13 per cent. Urine on examination showed 1 plus leucocytes and epithelial cells. Blood Wassermann test was negative.

Roentgen-ray photographs of the chest showed no unusual findings other than moderate relative elevation of the right dome of the diaphragm.

In considering what structure or structures might have given rise to the above mentioned swelling, it was felt that hernia could at once be ruled out on account of the chronicity of the process and its lack of subjective symptoms; aneurysm by the lack of impulse or thrill; and an intra-abdominal abscess, tumor or

psoas abscess by the fact that the mass so clearly seemed to lie in the abdominal wall only. It seemed quite clear that the structures primarily involved in the mass were the right inguinal group of lymph glands, involved either in a chronic infectious or malignant process, and if malignant, either primary or metastatic. Infectious processes to be considered were tuberculosis, or possibly a granuloma secondary to some chronic infectious focus in the genitalia or rectum, evidence of which was wholly lacking.

Primary neoplasms to be considered were benign lymphoma, lymphosarcoma, pseudoleukemia, Hodgkin's disease, and the large round cell lymphosarcoma of recticular origin. Metastatic neoplasms to be considered, in the absence of other demonstrable glandular enlargement, were carcinoma and sarcoma, more likely the round cell sarcoma and less likely the spindle celled. The absence of a present chronic pyogenic infectious focus which these glands might drain, or the history of such a focus previously existing, seemed to weigh against such a cause for the tumor. Tuberculosis, primary or more probably metastatic, we felt could not definitely be ruled out, and in spite of absence of history, symptoms, or physical signs of tuberculosis elsewhere, was consistent with the clinical development of the process, its painlessness and its remission and subsequent exacerbation.

In the matter of neoplasms, the failure to find a primary source would not necessarily rule out metastatic sarcoma or carcinoma, but the chronicity and the isolation of the mass seemed to do so. The blood picture ruled out a myxoma or lymphoma of leukemic origin. Hodgkin's disease, pseudoleukemia, lymphosarcoma, and benign lymphoma remained, and of these Hodgkin's seemed the most likely, because it could better be reconciled to the chronic nature of the mass and its regression and recurrence than any of the other three. The chronicity and isolation of the tumor were the hardest facts to explain on a neoplastic basis, and finally led us to the erroneous working diagnosis of tuberculosis.

An operation was performed on March 1, 1927, under ethylene oxygen anesthesia, through an incision similar in length but a little lower than that of an inguinal hernia operation. It revealed marked edema and induration of the skin and subcutaneous tissue down to the deep layer of the superficial fascia. Beneath this layer of fascia in the region normally occupied by the right chain of inguinal glands, there was a firm, elastic irregularly lobulated mass which could be separated fairly easily by blunt dissection. Carrying this blunt dissection around the edges of the mass, it was soon found that contrary to its relation to the superficial fascia, the mass was firmly attached in places to the aponeurotic fascia of the external oblique and rectus sheath, and definitely infiltrated these structures. This being the case, such of the mass as had been freed, altogether a piece about 4 by 6 by 6 cm. in size, was removed for frozen section, leaving behind what felt like about an equal amount of residual tissue, which even more definitely seemed to infiltrate its surroundings. In one place where the mass had surrounded what was apparently the superficial epigastric vein, this vein was torn across, revealing a cord of tissue lying free in the lumen of the vessel.

As frozen section showed the mass not only to be neoplasm, but from all appearances a definitely malignant one, further attempt to eradicate the tissue was abandoned in favor of roentgen-ray therapy.

The patient's wound has healed without infection or rise of temperature or pain, but with a small collection of bloody serum, due probably to the edematous wall of the wound failing to fall in and properly close the dead space left by the partial enucleation of the tumor mass. On the sixth day, the stitches were removed, and on the seventh day he was given the first of three deep roentgen-ray treatments. The other two were to follow during the week.

Follow-up note. Following roentgen-ray treatment the wound broke down in an area 3 cm. in length and there was drainage of serosanguineous fluid and bits of necrotic tissue for six weeks. Meanwhile the induration and remaining mass of tumor tissue improved and decreased steadily, and on follow-up visits at the end of six weeks and three months after operation the wound had healed and no tumor tissue can be felt, nor extension elsewhere demonstrated.

Dr. Hartman's *pathological note:* I received this lobulated confluent mass of glands, which were not really encapsulated but surrounded by fibrous tissue. In making a section through this mass, the tissue was grayish pink in color, granular and semitranslucent, with glistening surface, an appearance which we always get in a malignant tumor. Sections from this mass showed that the architecture of the lymph glands was entirely destroyed and consisted of small round cell types, with many mitoses, as many as five or six in the low-power microscopic field. A pathological diagnosis of lymphosarcoma was made.

Dr. McClure: Tumors in the inguinal region such as this one are extremely interesting, for the correct diagnosis is not easy and sometimes is correctly made only at the operating table. Dr. McGraw's statement that the diagnosis of hernia had been ruled out in this case calls to mind a case where the surgeon thought he had ruled out the possibility of hernia and performed a biopsy in a dispensary. His patient had an inguinal mass of equal size, which at times became a little larger and at times a little smaller. It was a hard, indurated irregular mass. The operator was suprprised when he cut into the tumor to find gas and fecal material appearing. The patient had had no cramps nor recent obstructing symptoms. The diagnosis in this case was Richter's hernia of long standing, with an inflammatory reaction around the nipple of bowel caught in the sac. There was very little or no narrowing of the lumen of the bowel, so there was no intestinal obstruction. This patient made a very satisfactory recovery, though a resection of the involved portion of the small intestine had to be done.

CYST OF THE PROSTATE GLAND WITH CONGENITAL ABSENCE OF THE RIGHT KIDNEY*

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NEW HAVEN, CONN.

THROUGH the courtesy of Dr. Clyde Leroy Deming, I am permitted to report the following case from the Department of Urology, Yale University and New Haven Hospital.

The patient is a male twenty-four years old, a clerk by occupation, who first reported to our clinic in April, 1923. At that time his chief complaint was frequency in urination. For the preceding four years he had had periodical attacks of frequency, each attack lasting for about ten to fourteen days. The onset of each attack was marked by frequency, with dysuria at the beginning and the end of urination. As the attack progressed, frequency and dysuria became more severe, urination occurring every ten to fifteen minutes. On the eighth to the tenth day the symptoms reached their height and by the tenth to the fourteenth day all symptoms would disappear. He never had hematuria, chills or fever or any pain in the back or flanks. Constipation and rectal tenesmus were present during the attacks and the bowels moved only with enemas.

Between attacks the patient had perfectly good health. He had been married two years. There were no abnormal sex symptoms.

In February, 1923, three months previous to admission, he had had an operation for repair of right indirect inguinal hernia and undescended testicle, which had been successful.

The physical examination revealed a well-developed young man of twenty-four, mentally alert and cooperative. The general physical examination was essentially negative except for the recent scar of the right inguinal herniotomy wound.

Urological Examination. There was no deformity of the external genitalia; no urethral discharge. The right testis was slightly smaller than the left, and located in the upper half of the scrotum; the left testis and epididymis were normal.

Rectal Examination. The sphincter was of good tone. The region of the prostate was occupied, especially on the left side, by a rounded cystic mass which was about 4 cm. in diameter and about 3 cm. in width. It seemed to occupy the position of the left prostatic lobe and extended halfway across the right lobe. It extended upward, covering the base of the left seminal vesicle and continuing slightly across the midline to the base of the right seminal vesicle. The mass was adherent, especially along the outer surface. Palpation of the mass did not present any unusual tenderness, and felt like a thin-walled cystic body. The right and left seminal vesicles were normal in size and consistency. The right lobe of the prostate was about one-half its normal width. The notch between it and the mass was well made out. The mass did not impinge on the rectal lumen or upon the membranous urethra. The posterior wall of the bladder was smooth; the rectum was within normal limits.

Cystoscopic Examination. The cystoscope was readily introduced and went almost straight into the bladder. Residual urine was 400 c.c. The bladder capacity was 500 c.c. A study of the bladder mucosa revealed no pathology. The most striking

*Read before the New York Academy of Medicine, Section of Genito-Urinary Surgery, on October 19, 1927.

feature within the bladder was the elevation of the trigone and right side of the bladder by an extravesical mass. The cystoscope could not be depressed, due to the mass in this region. The mucous membrane over the mass was normal, and the left ureteral orifice could be seen well up on the left side. It was large and could be observed functioning. Careful search for the right ureteral orifice was unsuccessful. The trigone, also, could not be followed all the way across the posterior wall of the bladder on account of the mass. On withdrawal of the cystoscope the posterior urethra was examined. The verumontanum was normal. The posterior urethra was somewhat reddened but no abnormal condition was seen. A large Garceau catheter was passed on the left side to the kidney pelvis.

Examination of bladder and ureteral specimens of urine were negative, both chemically and microscopically.

The phthalein test on the left side was 55 per cent in thirty minutes. The appearance time was two and one-half minutes. The patient voided about 30 c.c. three minutes after the Garceau catheter was removed and only a trace of phthalein was obtained from the bladder. We therefore concluded that in all probability the right kidney was absent. The routine laboratory data was normal.

Our impression at the time was: (1) cyst of the prostate gland; (2) congenital absence of right kidney; (3) cyst or diverticulum of the seminal vesicles.

Operation was advised, but the patient refused treatment and returned home.

In April, 1926, three years after his first visit, the patient returned with practically the same story seeking operative assistance.

He was operated upon, a perineal incision being made. The prostate was easily exposed. A seminal vesicle retractor was placed in the bladder through the urethra. On exposure of the prostate the normal gland and seminal vesicles were noted. After stripping off a rather heavy prostatic capsule a normal prostatic tissue was encountered, which lay more on the left than the right. A portion of it was removed. Beneath this tissue was a cyst with many ramifications which occupied the right side of the bladder running upward for 6o8 cm. and across to the left side and forming an area about the size of a thumb. It was not unlike a pelvis of a kidney. The cyst was filled with half an ounce of bile-colored viscid fluid. It was lined with a very delicate membrane-like coat which was extremely adherent to the surrounding structures. There was no connection with the urethra or bladder. It was difficult to decide at operation whether it were a cyst of the prostate, a cyst of the seminal vesicle or a congenital malformation of a kidney.

A small wound was made in the posterior urethra for exploration. The cyst was drained with a small rubber tube and small cigarette drain.

The postoperative convalescence was not remarkable. For the first few days there was considerable drainage of blood and urine. These very shortly decreased in amount and in a week the patient began to void through the normal route. Ten days postoperative, drainage ceased by perineal incision. The patient was discharged with incision completely healed and in good condition on the eighteenth day. It is now a year and a half since operation and during this period he has remained in excellent health.

We feel that this case is worthy of presentation because of its rarity as a clinical entity. I have been informed by our Department of Pathology that multiple small cysts of the prostate are commonly found at autopsy. In no case, however, have they caused symptoms. Here and there in the literature we find cases described, but these are exceedingly rare and have been ably reviewed in a recent article by Dr. Miley Wesson of San Francisco. We hope that the report of this case will be of some help to others in the diagnosis of this condition.

SARCOMA OF LONG BONES*

CLINICAL LECTURE ON END RESULTS

WILLIAM B. COLEY, M.D., F.A.C.S.

NEW YORK

Bone Sarcoma. Exhibition of patients illustrating end-results of treatment.

CASE I. C. S., male, aged thirty-nine years. Periosteal osteogenic sarcoma of tibia involving 6 inches of shaft, with extensive metastases in the femoral, inguinal and iliac glands. The patient was treated with the mixed toxins of erysipelas and Bacillus prodigiosus combined with radium (March, 1917). *Result:* complete recovery, limb saved, patient in excellent health at the present time, ten and one-half years later.[1]

In this case, the microscopic diagnosis by Dr. James Ewing was confirmed by the Committee of the Bone Sarcoma Registry (registered as Case No. 183). It is of special interest inasmuch as it is the only registered case of periosteal sarcoma in which the limb was saved and the patient remained alive for a period of more than five years. Furthermore, it is the only case in the Bone Sarcoma Registry in which a patient with metastases has been cured by any method of treatment, with the exception of two other cases of Dr. Coley that have remained well for seven and eight years respectively, both of which were treated with toxins and radium.

CASE II. R. H., male, aged thirty-six years. Very extensive inoperable sarcoma of middle and upper third of shaft of femur involving as far as the trochanter (clinical and roentgen-ray diagnosis). This was a malignant, rapidly-growing sarcoma of the femur (probably of the endothelioma type) which was entirely inoperable at the time of Dr. Coley's first observation in October, 1917. The tumor followed a recent fracture, and completely destroyed 5 inches of the shaft. There was a pathological fracture. *Treatment:* injections of the mixed toxins for eight months and one radium-pack treatment. *Result:* complete recovery, reunion of bone (5 inches' shortening); patient has a useful limb and is able to walk about without a crutch or cane, ten and one-half years later.[2] This is Case No. 210 in the Bone Sarcoma Registry. (See Figs. 1 and 2.)

FIG. 1. Inoperable sarcoma (probably endothelial myeloma) involving one-half of shaft of femur; destruction of five inches of shaft. Pathologic fracture. Complete recovery under eight months' treatment with toxins of erysipelas and Bacillus prodigiosus and one treatment with radium pack (40,000 mc.-hrs.). Firm union of bone; patient well ten years later. For roentgenograms before treatment *vide Archives of Surgery* (Coley) January, 1927.

CASE III. H. S., male, aged eight years. Periosteal sarcoma of fibula (Ewing's diagnosis: endothelioma) with extensive metastases in femoral, inguinal and iliac glands, and also in lungs. Treated by amputation (May, 1920) followed by toxin treatment for four months and one

* Given to the visiting members of the Royal Society of Medicine (Surgical Section) at the Hospital for Ruptured and Crippled on September 20, 1927.

application of radium pack to large mass (size of child's head) in iliac fossa. *Result:* complete disappearance of metastatic tumors. Patient well at present, seven and one-half years later. (Treated at the Hospital for the Ruptured and Crippled and Memorial Hospital.)

Fig. 2. Patient of Figure 1 five and one-half years after treatment was begun.

In this case, a gland in the groin was removed at biopsy and examined microscopically by Dr. James Ewing, who pronounced it a sarcoma of the endothelioma type.[3] This is Case No. 267 in the Bone Sarcoma Registry. (See Fig. 3.)

Case iv. L. G., female, aged nineteen years. Central sarcoma of entire lower end of femur with extensive involvement of knee joint. Ewing's diagnosis: giant and spindle cell sarcoma of moderate malignancy. Bone Sarcoma Registry diagnosis: benign giant cell tumor. A biopsy was performed, but no curettage. *Treatment:* injections of the mixed toxins of erysipelas and Bacillus prodigiosus (no other treatment). *Result:* complete recovery; limb saved; 2 inches' shortening of bone and stiff leg. Patients walks without support of any kind, and is in excellent condition thirteen years later.[4] This is Case No. 180 in the Bone Sarcoma Registry.

Three years ago she developed a rapidly growing tumor of the right breast; good recovery. Extensive involvement of the

Fig. 3. Periosteal sarcoma of fibula, endothelial myeloma type (Ewing) with extensive metastases in the groin and iliac fossa (diagnosis confirmed by microscopical examination) also metastases in lungs. Amputation followed by three months' treatment with mixed toxins of erysipelas and B. prodigiosus; one radium pack treatment to large metastatic tumor in iliac fossa; no radiation of chest. Complete recovery; patient well seven and one-half years later.

breast, pronounced carcinoma by Dr. Ewing and Dr. Wood. Patient was given prophylactic toxins and local roentgen rays. No recurrence in more than three years.

Case v. C. F. female, aged seventeen years. Central sarcoma of upper end of tibia. Ewing's diagnosis: giant cell sarcoma of epulis type, very moderate degree of malignancy. Pronounced malignant by Drs. George Barrie and MacCarty of the Mayo Clinic. *Treatment:* curettage and toxin treatment for three months. On discontinuing treatment a recurrence took place. Second curettage followed by further toxin treatment and one application of radium pack. *Result:* complete recovery;

limb saved; patient well over twelve years later.[5] This is Case No. 145 in the Bone sarcoma Registry. (See Figs. 4, 5 and 6.)

Case VI. H. J., male, aged twenty-two years. Periosteal sarcoma of femur (Ewing: endothelioma type) treated with toxins for six weeks before amputation; temporary decrease in size of tumor. Amputation in December, 1909, followed by two courses of toxin treatment. *Result:* patient well seventeen and three-quarter years later.[6] This is Case No. 398 in the Bone Sarcoma Registry.

Case VII. H. S., male, aged nineteen years. Periosteal osteogenic sarcoma of femur, treated with toxins and radium before amputation. Temporary improvement. Amputation performed, followed by prophylactic toxin treatment. *Result:* patient well over seven years after amputation.[7] This is Case No. 172 in the Bone Sarcoma Registry.

Case VIII. E. M., male, aged forty-seven years. Perisoteal sarcoma of upper two-thirds of humerus (endothelioma type) inoperable. Registry diagnosis: endothelioma or Ewing's tumor. Treated with toxins and radium. *Result:* complete recovery, reunion of pathological fracture, patient has perfect function three and one-half years later.[8] This is Case No. 596 in the Bone Sarcoma Registry.

Case IX. J. L., male, aged twenty-one years. Periosteal osteogenic sarcoma of femur. Treated with radium for three months without control of tumor. Amputation, followed by prophylactic toxin treatment. *Result:* patient well three and one-third years following amputation.[9] This is Case No. 598 in the Bone Sarcoma Registry whose diagnosis was that of osteogenic sarcoma.

Case X. E. P., female, aged thirty years. Periosteal osteogenic sarcoma of lower end of femur. Treated with prolonged radiation and a short course of toxin injections, without controlling tumor. Amputation performed followed by prophylactic toxin treatment. *Result:* patient well over ten years after amputation.[10] This is Case No. 100 in the Bone Sarcoma Registry.

Case XI. I. H., male, aged thirty-six years. Giant cell sarcoma of lower end of femur. *Treatment:* excision of one condyle by Dr. Hartwell and Dr. Dudley in June, 1923. A recurrence took place one year later, following which the patient was put upon high voltage roentgen-ray treatment administered by Dr. Herendeen. *Result:* patient in good health

Fig. 4. Very extensive giant- and spindle-cell sarcoma of lower end of femur with involvement of knee-joint. Biopsy but no curettage. Toxin treatment for nine months. No radiation. Complete recovery, 2½ inches' shortening; stiff knee; otherwise useful leg. Patient well thirteen years later.

with no recurrence, four years after the first operation. While there is considerable limitation of motion, the patient is able to walk very well with a cane.[11]

Case xii. G. M., male, aged twenty-six years. Benign giant cell sarcoma of lower end of femur, of very extensive involvement. Pathological fracture. Treated with radium by Dr. Quick (90,000 mg.-hrs. in nine months' pack treatment). *Result:* reunion of fracture, full

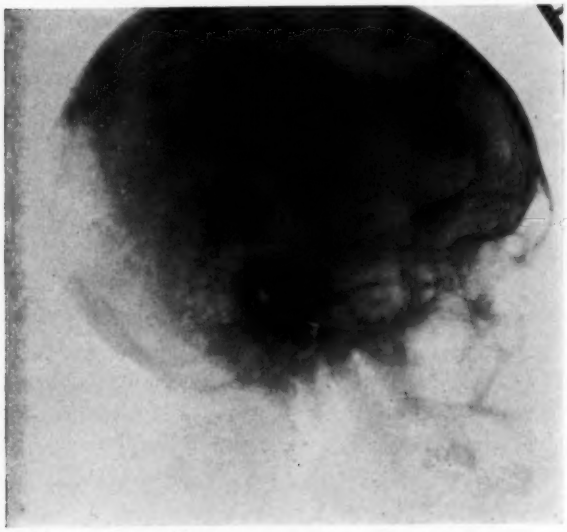

Fig. 5. Preceding case one year after treatment.

restoration of function, patient in good condition five and one-half year later. While there is at present some dermatitis resulting from early radium treatment, and considerable atrophy of the soft parts due to endarteritis, the patient has a useful limb and there is no evidence of a recurrence.[11] This is Case No. 320 in the Bone Sarcoma Registry.

Case xiii. K. K., female, aged seventeen years. Giant cell sarcoma of lower end of tibia, recurrent after two operations. Recovery under prolonged toxin and roentgen-ray treatment. *Result:* limb saved, complete restortation of function, patient in good health twenty-three years later.[12]

Case xiv. L. D. G., male, adult. Sarcoma of lower end of radius with complete destruction of bony shell and three inches of bone. *Treatment:* systemic injections of mixed toxins of erysipelas and Bacillus prodigiosus. *Result:* complete disappearance of tumor regeneration of bone, restoration of function, and patient in good condition nine years later.[13] This is Case No. 211 in the Bone Sarcoma Registry.

Case xv. W. B., male, aged twenty-eight years. Inoperable osteogenic sarcoma of occipital bone following recent trauma; there was complete destruction of both tables of the skull. Exploratory operation

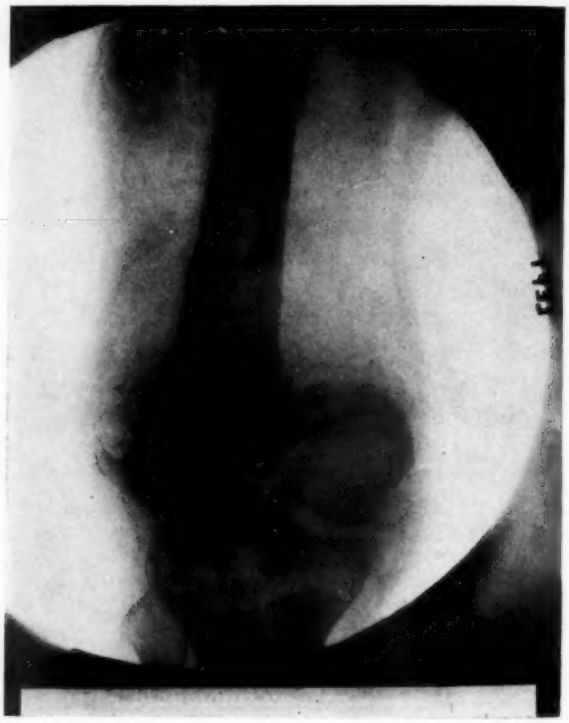

Fig. 6. Preceding case five years after treatment; showing Nature's attempt to form new condyle.

revealed a tumor extending down to the dura. Diagnosis was confirmed by microscopic examination by Dr. James Ewing. *Treatment:* systemic injections of toxins combined with local radium treatment for eight months. *Result:* complete recovery; clinical and roentgen-ray examination shows no evidence of disease three years later. (See Figs. 7 and 8.)

This case is a typical example of acute traumatic malignancy. The tumor started in a small hematoma, two weeks after an injury caused by a heavy wooden packing-case falling and striking the patient on the top of his head.[14]

Case xvi. S. D., female, aged eighteen years. Very extensive periosteal osteogenic sarcoma of lower end of femur. Registry diagnosis: osteogenic sarcoma. Patient was very emaciated at the time of exploratory operation (March, 1906) and the prognosis was very grave. *Treatment:* amputation followed by prolonged prophylactic toxin treatment. *Result:* patient in excellent health, twenty-one and one-half years after amputation.[15] This is

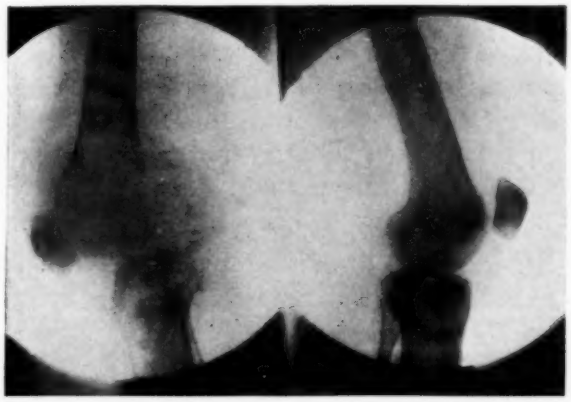

Fig. 7. Osteogenic sarcoma of occipital region of skull involving both tables and extending to dura mater. Recovery under toxins and radium-pack treatment. Patient well three years later.

Case No. 408 in the Bone Sarcoma Registry.

Case xvii. C. P., male, aged twenty-eight years. Sarcoma of tibia and fibula (angioendothelioma type) with multiple metastases in the lungs. *Treatment:* toxins and roentgen ray. Temporary control. Amputation performed three years later, followed by prophylactic toxin treatment. Patient in good condition one and one-half years later. This is Case No. 574 in the Bone Sarcoma Registry. This patient has received a very large amount of radiation—roentgen rays, twenty-five exposures, eighty minutes each—without any ill effects.

Case xviii. J. R., male, aged nine years. Myositis ossificans. In the following case, the clinical and microscopic findings closely resembled those of osteogenic sarcoma. The patient fell, striking his shoulder on a hard floor. A swelling developed almost immediately after and increased in size; this was accompanied by a temperature of 101 or 102° f. Clinically the condition seemed characteristic of osteomyelitis. An exploratory operation was performed by Dr. J. F. Black, revealing a tumor in the upper end of the humerus, apparently springing from the periosteum. A mass of tumor tissue, firm in consistency, measuring about ½ by 2 inches, was removed and examined microscopically. The diagnosis

Fig. 8. Preceding case three years after treatment was begun.

of the local pathologist was that of osteogenic sarcoma, which was confirmed by Dr. Ewing and Dr. Wood. The condition was apparently inoperable. The patient was referred to Dr. Coley and admitted to the Hospital for the Ruptured and Crippled in early February, 1927.

The toxin treatment was begun, and in a short while the swelling diminished markedly in size. At the end of two weeks a hard, bone-like tumor could be felt posteriorly, apparently connected with the upper end of the humerus. No radiographs could be taken for two weeks because the ward was under quarantine. At the end of this time, roentgen-ray examination showed a condition entirely different from

that originally observed. While the film showed a large amount of new bone formation which seemed typical of osteogenic sarcoma of periosteal origin, a stereoscopic series showed quite clearly that the new bone was not connected with the humerus but was situated in the muscle tissue about the upper end of the humerus. A diagnosis of myositis ossificans was made and no further treatment was given. The patient is in excellent condition several months later. He received one treatment with the radium pack before the correct diagnosis was made.

Dr. Coley stated that the foregoing case was one of the most difficult ones in which to make a differential diagnosis that had ever come under his observation. He showed radiographs and lantern slides of another very similar case of the shaft of the femur in which the diagnosis was equally difficult. While the microscopic picture in both cases closely resembled that of an osteogenic sarcoma, the fact that a tumor of considerable size appeared within less than two weeks after an injury should have raised doubts as to the correctness of a diagnosis of osteogenic sarcoma, and should have pointed rather clearly to a diagnosis of myositis ossificans.

In this earlier case, several roentgenologists had pronounced the condition to be that of periosteal persistent sarcoma, and a number of distinguished pathologists had confirmed the diagnosis of osteogenic sarcoma. In this case Dr. Ewing had made a correct diagnosis of myositis ossificans. Dr. Coley gave no treatment; and the patient is well after nearly four years later.

Case xix. J. C., male, aged fifteen years. Periosteal osteogenic sarcoma of upper end of tibia. Treated with toxins and radium, without control of tumor. Amputation performed on December 2, 1921, followed by prophylactic toxin treatment. Patient well six years later.[16] This is Case No. 177 in the Bone Sarcoma Registry.

Case xx. The following case Dr. Coley regards as a unique example of the curative influence of the streptococcus of erysipelas upon an inoperable melanoma. This patient, V. B., female, at the age of two and one-half years suffered from an inoperable melanotic sarcoma of the neck. Under an accidental attack of erysipelas the disease entirely disappeared. Five years later she developed a rapidly growing round cell sarcoma in the glands of the neck (no pigment in tumor). This tumor disappeared under prolonged toxin treatment and one application of the radium pack. The patient is in excellent condition with no evidence of a recurrence, eleven years after the disappearance of the melanoma and six years after the disappearance of the round cell sarcoma. The diagnosis of both tumors was confirmed by Dr. James Ewing.

This case was reported by Dr. Coley before the New York Surgical Society, five years after the cure of this melanoma, and later after the cure of the round cell sarcoma of the neck. The patient was under the care of Dr. R. C. Bryan of Richmond, Virginia, at the time of the original trouble, and was later referred to Dr. Coley.

SUMMARY OF CASES

Dr. Coley stated that the cases just shown had been treated at the Memorial Hospital and at the Hospital for Ruptured and Crippled. He summarized them briefly as follows:

Seven cases of the osteogenic type, of which 5 were well from five to twenty years, and 2 were well over three years.

Five cases of the endothelioma type, of which 4 were well from three and one-half years to seventeen years, and one was well a little over three years.

Six cases of the giant cell or giant and spindle cell type, in all of which the limb was saved, and the patients have remained well from four to twenty-three years later.

In the 12 cases of periosteal osteogenic sarcoma, including the endothelioma type, the limb was saved in 3 cases. Of this group, 8 patients have remained well from

five to twenty years later. In 2 cases metastases had developed.

DISCUSSION BY DR. COLEY

In connection with the presentation of case histories illustrating the end-results in sarcoma of the long bones following different methods of treatment, time will permit only a very brief discussion of the choice of methods; and I shall merely touch upon the difficulties associated with the early diagnosis of bone sarcoma, which sometimes are real and troublesome. Those who wish to know more about my views upon bone sarcoma are referred to my longer paper on the subject published in the *Archives of Surgery*[1] and to a more recent publication in the *Annals of Surgery*.[17]

It may be recalled that I was one of the earliest surgeons to advocate the conservative treatment of sarcoma of the long bones, having published a paper on the subject in 1907,[18] and another at the Congress of French Surgeons in 1919. While I continue to be a firm believer in conservative treatment, I think that I am now regarded by many of my colleagues as being too radical, because further experience with the disease has led me to the conclusion that conservative treatment has certain definite limitations, depending upon the histological and clinical type of the tumor in question. I believe that amputation alone is able to cure but a very small number of cases of periosteal osteogenic sarcoma; but early amputation followed by prolonged treatment with the mixed toxins of erysipelas and Bacillus prodigiosus, in my experience, has resulted in an apparent cure in 50 per cent of the cases of periosteal sarcoma (osteogenic, including endothelioma). In proof of this I cite the results in a group of 40 cases treated by this method: 20 have remained well from three to eighteen years.

In regard to radiation: for more than ten years the Memorial Hospital has been the fortunate possessor of a very large amount of radium; and in view of the practically hopeless prognosis of periosteal sarcoma under surgical treatment alone, a serious effort has been made to determine whether or not better results were obtainable by radiation. During this period, nearly all the cases of bone sarcoma, including giant cell sarcoma, that applied to the Memorial Hospital have been treated by radiation as the method of choice. However, personal cases and those that have come under my own care at the Hospital for Ruptured and Crippled, I have continued to treat in the old way, that is, the giant cell group by curettage followed by toxins, alone or combined with radium; the osteogenic group, by early amputation followed by toxins; and in the group of rapidly growing round cell sarcoma of the shaft (now generally classified as endothelioma or Ewing's tumor) I have made an attempt to save the limb by a thorough course of systemic injections of the mixed toxins combined with local radiation, reserving amputation for only such cases as failed to show marked improvement under this treatment. The results obtained by these various methods of treatment have been recorded in the papers already mentioned.

While the Memorial Hospital has definitely proven—and I believe was the first hospital to prove—that giant cell sarcoma of the long bones may be cured by radiation alone, since 5 cases there treated have remained well for more than five years, I am not yet convinced that radiation is the method of choice. My two main reasons for this opinion are: (1) because of the longer period of time required to effect a cure and the correspondingly longer period of disability, an important matter with working men; and (2) because it is impossible to make a correct diagnosis of giant cell sarcoma of the long bones in more than 75 or 80 per cent of the cases from clinical and roentgen-ray evidence alone. We have found in 1 out of 4 cases at the Memorial Hospital, diagnosed clinically and by roentgen ray as benign giant cell tumor, and the patient treated for a long time by radiation alone, that the tumor later proved to be a malignant central sarcoma; but by the time this discovery was made, the condition had become inoperable and all chance of saving the patient's life had been lost. Therefore, I now regard the following treatment of giant cell tumors to be the method of choice: (1) thorough curettage down to hard bone; (2) washing out the cavity with pure carbolic acid or zinc chloride; (3) packing the cavity with sterile gauze; (4) keeping the cavity clean with Dakin's solution; and (5) a few days after operation, starting a three or four months' course of prophylactic toxin treatment. In advanced cases, a single radium pack treatment might be used to advantage, but this should not be done until the cavity has been nearly filled by normal granulation, since radium increases the chances of infection.

I believe that the dangers associated with

curettage are no longer a serious drawback, since the introduction of Dakin's solution has made it possible to keep the wound clean. In my opinion, the method just cited makes it possible to save the limb in practically all cases of giant cell sarcoma, even those of the lower end of the femur with extensive involvement of the knee joint. I have had 2 such cases, one of which has just been presented. In the other, in which the disease was even more extensive, one treatment with radium was given after three months' treatment with toxins and after the cavity had filled up; this patient is alive and well, with perfect function, eight years later. This method, I believe, enables one to study the histology of the tumor, and thereby to eliminate the one-in-four error in diagnosis associated with treatment by radiation alone without biopsy—the method at present advocated by some surgeons and many radiologists. Simple biopsy without a complete curettage should never be done in giant cell tumors because of the danger of hemorrhage and the increased risk of infection.

Coming to periosteal osteogenic sarcoma of the long bones, the results obtained in 71 cases treated at the Memorial Hospital by radiation alone, as a primary method of choice, have led me to conclude that this method is associated with very definite risks, and is not the method of choice. The number of cases thus treated, I believe, is sufficiently large to include some cures, but as yet no case in which the diagnosis has been definitely established by biopsy has recovered under radiation alone and the patient remained well for three years. In 25 cases, the condition became inoperable, or the patient developed metastases while undergoing local radiation; and this, in spite of the fact that improvement in the local condition was noticed in several cases. In 29 cases in which amputation had to be resorted to after failure to control the tumor by prolonged radiation, only 2 patients survived the five-year period. In other words, primary treatment of an osteogenic sarcoma by radiation alone in my opinion distinctly lessens the chance of a cure by later amputation.

If amputation alone were the only alternative, one might feel that there were little choice; but when it has been found possible, as it has been, to save the life of the patient in 50 per cent of the cases by early amputation (before radiation) followed by toxin treatment, then it would seem that herein lies the method of choice.

Some surgeons have advocated preliminary radiation in early cases of osteogenic sarcoma, and in the event of no improvement, this to be followed several months later by amputation. The value of such a practice may be determined only by actual experience; but at present we have 32 cases so treated, of which only 3 have survived three years. The figures show little if any improvement over those of the group treated by early amputation alone, and far less than those treated by early amputation followed by toxin treatment.

In the group of so-called endothelioma, I believe that the prognosis after amputation alone is as grave as that found in osteogenic sarcoma, and that the former are even more prone to early metastases. On the other hand, all of these cases have been found to be very sensitive to radiation as well as to toxins; while the Bone Sarcoma Registry showed some cases of this type treated by radiation alone well for over four years, in most instances, after marked improvement has taken place (in some cases amounting to the entire disappearance of the tumor), the disease has recurred locally or in the form of metastases, and has proven fatal. Some of these cases of endothelioma have been cured by toxins alone and more by toxins and radium. I believe the method of choice for this group is as follows: local treatment by radium pack or roentgen ray combined with prolonged systemic treatment with the mixed toxins of erysipelas and Bacillus prodigiosus. The fact that a number of patients with extensive multiple metastases have recovered and remained well for from five to ten years following such treatment, in my opinion justifies a more general use of this method. In addition, a number of limbs have been saved by the adoption of this method. In my paper already referred to, the results in the endothelioma group are given as follows: of 26 cases of endothelioma, including round cell sarcoma without new bone formation, 13 are alive and well from three to fifteen years after. The treatment employed in these 13 cases was: operation and toxins in 4 cases; toxins and radium (in 2 cases after amputation) in 6 cases; operation and radium in 1 case; toxins alone in 1 case; radium alone in 1 case (this patient died at the end of three years; case of death unknown; no local recurrence).

Of our entire series of cases treated at the Memorial Hospital and at the Hospital for Ruptured and Crippled, we have no case of endothelioma of the long bones treated by radiation alone that has remained alive and well for more than three years.

REFERENCES

1. Coley, W. B. Primary malignant tumors of long bones; end-results in 170 operable cases. *Arch. Surg.*, 1927, xiv, 82.
2. *Ibid.*, p. 89.
3. *Ibid.*, p. 98.
4. Coley, W. B. Prognosis and treatment in giant-cell sarcoma. *Ann. Surg.*, 1927, lxxxvi, 136.
5. Coley, W. B. Periosteal spindle-celled sarcoma of the tibia, etc. *Ann. Surg.*, 1919, lxix, 654–657.
6. Coley, W. B. Primary malignant tumors of long bones; end-results in 170 operable cases. *Arch. Surg.*, 1927, xiv, 69.
7. *Ibid.*, p. 104.
8. *Ibid.*, p. 120.
9. Coley, W. B. Sarcoma of long bones. *Surg. Clin. N. Amer.*, 1925, v, 131.
10. Coley, W. B. Primary malignant tumors of long bones; end-results in 170 operable cases. *Arch. Surg.*, 1927, xiv, 84.
11. Coley, W. B. Prognosis and treatment in giant-cell sarcoma. *Ann. Surg.*, 1927, lxxxvi, 138.
12. *Ibid.*, p. 136.
13. *Ibid.*, p. 140.
14. Coley, W. B. Local injury as a causative factor in bone sarcoma with special reference to the medico-legal aspects. *Internat. J. Surg.*, 1926, xxxix.
15. Coley, W. B. Primary malignant tumors of long bones; end-results in 170 operable cases. *Arch. Surg.*, 1927, xiv, 75.
16. *Ibid.*, 101.
17. Coley, W. B. Prognosis and treatment in giant-cell sarcoma. *Ann. Surg.*, 1927, lxxxvi, 641.
18. Coley, W. B. Sarcoma of the long bones. *Ann. Surg.*, 1907, xlv, 321–368.
19. Coley, W. B. Le traitment conservateur du sarcome des os longs. Extrait des Comptes Rendus du 24th Congres de l'Association Francais de Chirgurie, 1911.

The American Journal of Surgery

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EDITORIALS

SURGEONS—REAL AND PSEUDO

IN most states one graduates from a medical school, passes a state board examination and is licensed to practice medicine and surgery. In New York State it so reads on the diploma granted by the University of the State of New York.

Without further training or experience the licensed practitioner is permitted by law to do any major surgical operation. His activities are limited only by the degree of faith he instills in the patient.

During the past thirty years surgery has been revolutionized. The finished surgeon successfully operates for conditions that were a half century ago almost always fatal. Surgery today is a commonplace. Men possessed of surgical ability are to be found in every hamlet and at every crossroad.

However, there is a class of physician who will attempt anything for financial gain. He is worse than the casual surgeon. Many of these men never have had an interne's life or worked as an apprentice to a surgeon of recognized ability.

These untrained men graduate, pass a state board examination, open offices and lay in wait for the unsuspecting victims. Without apprehension these surgical prostitutes attempt major surgery. A plausible tongue explains mortality. Morbidity is an unknown condition to this horde; a patient is marked "recovered" if he or she leaves the sanitarium alive. Naturally these men are never Fellows of the American College of Surgeons. They usually are connected with nothing. They possess keen financial judgment and ability, and are able to diagnose the size of the patient's ability to pay far better than the pathological condition—if present.

This state of things gives medicine, and especially surgery, a black eye, and the sound, ethical man suffers in turn.

What is the cure? We hesitate to suggest remedies! We are anxious to hear what our readers have to say on the subject. One man will urge that all graduates be compelled to become hospital internes; another, that legislation should be enacted making

major surgery possible only to those of training and skill; another might suggest that the American College of Surgeons educate the lay public to demand only a surgeon who is a Fellow of the College thereby knowing they have a surgeon both in fact and name and not a "specialist in all the branches of medicine."

This is not a new topic. The American College of Surgeons have hammered at this abuse and, as is their custom, made an excellent crusade. But withal the abuse is apparent and gains in size. There must be a remedy. It is time a stop was called to the activities of these surgical vultures.

JACOB SOLIS COHEN

JACOB Solis Cohen, who died on December 22, 1927, was one of the most notable figures in the history of laryngology in the United States.

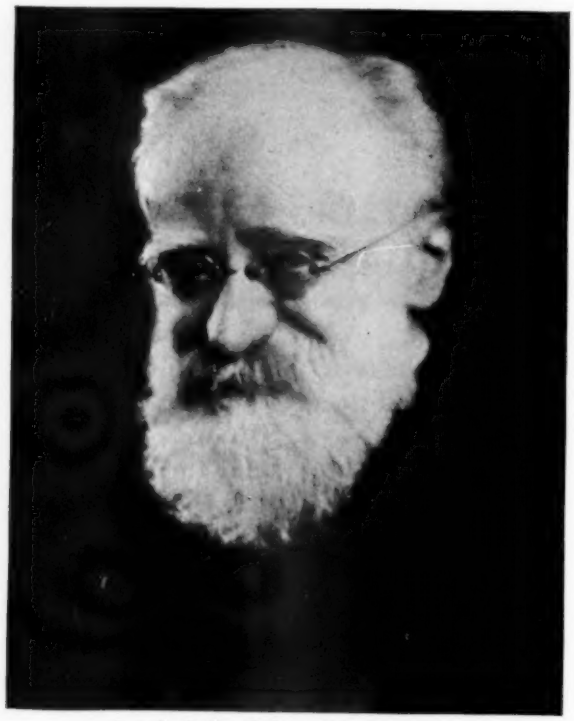
Dr. Solis Cohen was born on February 28, 1828, in New York City. Through both his father and mother he came of the very best Jewish stock. For hundreds of years his ancestors were active in public affairs and prominently connected with charitable and religious projects. His mother was the daughter of Jacob da Silva Solis, a wealthy philanthropist of New York, and through her he was related to the Hays and Etting families, both of which had been prominent in the patriotic cause during the Revolution. In 1840 his father moved to Philadelphia. After graduating from the Central High School young Solis Cohen attended lectures at Jefferson Medical College, but finished his medical education at the University of Pennsylvania. He received the degree of M.D. in 1860. He was appointed resident physician in the Philadelphia Hospital, but resigned at the end of six months to enter the United States Army. As no commission as an assistant surgeon was available, young Solis Cohen enlisted as a private soldier, but soon after received a commission as Assistant Surgeon in the 26th Regiment, Pennsylvania Volunteers. He served with this regiment in Hooker's Brigade. In September, 1861, he resigned from the Army to accept an appointment as an acting assistant surgeon in the United States Navy. He accompanied Dupont's expedition to Port Royal, and served on the South Atlantic Blockading Squadron of which he was for a time acting fleet surgeon. After resigning from the Navy in January, 1864, he was appointed visiting surgeon for two of the military hospitals then established in Philadelphia. At the Turner's Lane Hospital he performed one of the ninety-four successful ligations of the femoral artery done by army surgeons during the war.

About this time his attention was directed towards the then young speciality of laryngology. In 1867 he was made chairman of a committee of the American Medical Association to investigate the value of treatment by means of inhalation. His studies resulted in the publication of his first book, "Inhalation in the Treatment of Disease: Its Therapeutics and Practice," Philadelphia, 1867. A second edition appeared in 1876. In 1872 Solis Cohen published "Diseases of the Throat and Nasal Passages," which at once became a standard textbook. A second edition was published in 1879, and subsequent editions attest the continued popularity of this excellent work. In 1874 appeared his monograph, "Croup in its Relations to Tracheotomy," based on a study of over five thousand recorded cases. This work achieved a remarkable and well-deserved success. In 1879 he wrote for the "Health Primer" series a small book "The Throat and Voice." In addition to these books Solis Cohen contributed monographs on laryngological subjects to the more important encyclopedic publications of the day, such as the "International Encyclopedia of Surgery," and the "American System of the Practice of Medicine." He contributed many important papers to medical societies and current periodical medical literature. For many years he edited the laryngological department of the *American Journal*

of the Medical Sciences, and was one of the editors of the *Archives of Laryngology*. A profound scholar and a facile writer, his literary productions bear the mark of the highest culture as well as of scientific ability.

Solis Cohen was a bold and skilful operator, his training in general surgery standing him in good stead in his special field. In 1892 he performed a famous laryngotomy on a patient in the Jefferson Hospital, introducing several original features in technique. The patient lived many years after the operation and the writer of his notice heard him converse in a voice which was perfectly audible at a distance of fifteen feet.

Solis Cohen held many official positions. In 1871 he delivered the Mütter Lectures at the College of Physicians of Philadelphia. He was Professor of Physiology at the Wagner Institute of Science in Philadelphia. In 1867 he was appointed Lecturer on Electric Therapeutics in the Jefferson Medical College, and was one of the first visiting physicians elected to the Jefferson Medical College Hospital, on the opening of that institution. After teaching laryngology for many years in Jefferson Medical College he was made Honorary Professor of Laryngology there in 1883. One of the founders of the Philadelphia Polyclinic, he served for many years as Professor of Diseases of the Throat and Chest. He was also visiting physician to the German Hospital, physician to St. Mary's Hospital, and consulting physician to the Jewish Hospital. He was deeply interested in tuberculosis and was one of the early advocates of its outdoor treatment, serving as senior and consulting physician to the Home for Consumptives at Chestnut Hill, Philadelphia, and furthering Trudeau's work at Saranac most enthusiastically.



Jacob Solis Cohen (1828–1927).

Solis Cohen was a Fellow of the College of Physicians of Philadelphia. He served two terms as president of the Philadelphia County Medical Society, and was an honorary member of the Neurological Association of New York, of the Societè Francaise de Laryngologie, and of the

British Association of Laryngology and Rhinology. He took a very prominent part in the affairs of the American Laryngological Association, of which he was one of the founders, and was twice elected president. At the meeting of the Association in Washington in 1910, he was presented with a loving cup. He was also a member of the American Philosophical Society. Because of his war services he belonged to the Loyal Legion and other military orders and societies. He received honorary LL.D.'s from Jefferson Medical College and Temple University.

Dr. Solis Cohen had many interests besides those of study appertaining to his profession. He was an active member of the Academy of Natural Sciences and of the Franklin Institute, giving lectures at the latter on acoustics, as he also did at Stevens Institute and at Wagner Institute. For many years he was interested in various movements for political reform. He was a devoutly religious man and a profound Hebrew scholar, taking an active part in the work and worship of his synagogue, and aiding in the establishment of the Hebrew Educational Society, of which he was for a time the secretary.

Solis Cohen was greatly loved and respected throughout his long life. Behind his quiet, modest mien there was felt the force of a profound intellect and a strong will, and his influence for good was very great and will last long after he has departed to his well-earned repose.

FRANCIS R. PACKARD.

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[From Fernelius' Universa Medicina, Geneva, 1679.]

BOOKSHELF BROWSING

JOSEPH SCHMIDT, BARBER-SURGEON

LEROY CRUMMER, M.D.

OMAHA, NEB.

PRACTICALLY contemporary with Molière, whose merits as a true benefactor of medicine have recently been so well postulated by Courtney,[1] was Joseph Schmidt, Barber-Surgeon, of Augsburg. His life was the antithesis of the careers of the members of the Paris Faculty, whose faults were so caustically depicted by the famous French dramatist. His was not the pride of college, nor degree. He had no desire for the honors of the long robe, nor was he self-deceived concerning his position in life nor his aim in aiding the distressed. His portrait shows, I think, his satisfaction in the short robe, and he must have been quite willing to be classed with his famous predecessors, Braunchweig, Gersdorf, Hildanus, Bartsch and Paré, all of whom, save Paré, remained barber-surgeons to the end; and their methods and results mark the high places of surgery of the period, while the efforts of surgeons of the long robe have been forgotten and the pose of the faculty concerning surgery brings an ironical smile to the lips.

The history of surgery from the Renaissance to the Reformation is one long story of academic arrogance and resistance to innovation. Those who sat in the high places arrogated to themselves the power of conducting the relationship of the profession to patients, with total disregard of the psychology and habits of the latter. While those in power were so intent on conduct and etiquette, now termed ethics, practically every innovation was forced from below. While Saint-Côme might discuss the method of giving a female patient a clyster without touching the adjacent parts, the barbers were in actual practice attending to the injuries, the accidents, the deformities and the suffering of the sick, often forced to attempts to give relief, and not infrequently finding methods which were successful.

Of this type of surgeon who remained close to his people was Joseph Schmidt, "Barbirer Leib und Wund-Arzt," of Augsburg. Having made no great discoveries nor advanced the course of surgery in any well-organized form, he has remained practically unknown. The biographical dictionaries have but meager information, based only, it seems to me, on the survival of several books written by him, in one of which his portrait giving his age justifies the computation that he was born in 1601. His "Spiegel der Anatomiae" is most fascinating, and behind it is the story of the evolution of the format of books on anatomy, in the dedication and preface are hints concerning the state of the practice of surgery in the first half of the

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seventeenth century, and between the lines can be gauged the mental and practical equipment of the author.

This "Mirror of Anatomy" is one of the earliest if not the earliest effort to produce a pocket compendium of anatomy. Attempts to fit the subject matter of anatomy to the proper book format began immediately after the publication of the master work of Vesalius and continued long after the period when Joseph Schmidt thought he had the proper solution. The unwieldy Fabrica yielded almost at once to the more easily handled thin folios of Geminius and Valverdus. This format was reprinted and copied a dozen times to one new edition of the Fabrica in its old form. Efforts by several publishers to pirate and print the text of Vesalius in smaller volumes without the illustrations of Van Calcar were frank failures, in spite of the famous name of Fuchs on the title page of one of these piracies. Paré in his "Anatomie Universelle," Paris, 1561, published an illustrated work in octavo which must have been a success since so few copies have survived, but this attempt was not repeated. Variola and Albertus published books with a few illustrations in octavo, and editions of Columbus and Fallopius without illustrations are not uncommon. Aselli's "De Lactibus," originally published in quarto with folio plates, had been twice reprinted with the plates re-ingraved in quarto. The works of Vesling and Bartholinius, in smaller format, were issued in the same decade as this effort of Schmidt, so we can give this author credit for making a true claim when he gives in his preface as his final reason for publishing his "Spiegel": "Especially however in the comfortable form to which illustrations of all times were added, none to my knowledge have hitherto been published and not everybody can buy one of the big expensive anatomies or even carry it with him." He makes this claim even more definite on the false title which divides the two parts of his work. This title speaks first of the cuts of all parts of the body drawn from life with the most accurate description, and adds "hitherto never brought together in such a small anatomical work."

There is a world of information buried in the dedications, prefaces and introductions of these old books. The poems of praise dedicated to the authors and the poetical efforts of the authors themselves, which are found in many of these books, also yield information scarcely considered by medical historians. Even Vesalius attempted this form of poetry. From the preface of the "Spiegel" may be ascertained that Schmidt came from a family of barber-surgeons. His father belonged to the guild and properly instructed Joseph and his brothers in the secrets and art of surgery, including home training in anatomy. Joseph Schmidt had the definite appointment of staff surgeon to Captain Artoloria, serving five years, and upon the basis of this army experience he wrote and published in 1644 at Augsburg, "Examen Chirurgicum."[1] He also tells us that he had continued his anatomical studies while with the army and had prepared and mounted skeletons "of which two still exist."

Of greater interest perhaps than these strictly personal details is the insight to be derived from studying his preface concerning his methods of thinking and writing and the beliefs and superstitions prevalent at this period. The dedication, addressed to eleven of his superior friends at Augsburg, breathes with the spirit of the fundamentalists, convinced of their eternal truth; he repeats the theological dogmas which guided thought disasterously through the doctrine of signatures and similar superstitions for so many years. The basis of much irrational medical thought may be found in the belief in the false syllogism: Since God has created man in his own image, he has concealed somewhere the material means for the alleviation of

[1] See, Index Catalogue of the Library of the Surgeon General's Office, U. S. A.

[From Fernelius' Universa Medicina, Geneva, 1679.]

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seventeenth century, and between the lines can be gauged the mental and practical equipment of the author.

This "Mirror of Anatomy" is one of the earliest if not the earliest effort to produce a pocket compendium of anatomy. Attempts to fit the subject matter of anatomy to the proper book format began immediately after the publication of the master work of Vesalius and continued long after the period when Joseph Schmidt thought he had the proper solution. The unwieldy Fabrica yielded almost at once to the more easily handled thin folios of Geminius and Valverdus. This format was reprinted and copied a dozen times to one new edition of the Fabrica in its old form. Efforts by several publishers to pirate and print the text of Vesalius in smaller volumes without the illustrations of Van Calcar were frank failures, in spite of the famous name of Fuchs on the title page of one of these piracies. Paré in his "Anatomie Universelle," Paris, 1561, published an illustrated work in octavo which must have been a success since so few copies have survived, but this attempt was not repeated. Variola and Albertus published books with a few illustrations in octavo, and editions of Columbus and Fallopius without illustrations are not uncommon. Aselli's "De Lactibus," originally published in quarto with folio plates, had been twice reprinted with the plates re-ingraved in quarto. The works of Vesling and Bartholinius, in smaller format, were issued in the same decade as this effort of Schmidt, so we can give this author credit for making a true claim when he gives in his preface as his final reason for publishing his "Spiegel": "Especially however in the comfortable form to which illustrations of all times were added, none to my knowledge have hitherto been published and not everybody can buy one of the big expensive anatomies or even carry it with him." He makes this claim even more definite on the false title which divides the two parts of his work. This title speaks first of the cuts of all parts of the body drawn from life with the most accurate description, and adds "hitherto never brought together in such a small anatomical work."

There is a world of information buried in the dedications, prefaces and introductions of these old books. The poems of praise dedicated to the authors and the poetical efforts of the authors themselves, which are found in many of these books, also yield information scarcely considered by medical historians. Even Vesalius attempted this form of poetry. From the preface of the "Spiegel" may be ascertained that Schmidt came from a family of barber-surgeons. His father belonged to the guild and properly instructed Joseph and his brothers in the secrets and art of surgery, including home training in anatomy. Joseph Schmidt had the definite appointment of staff surgeon to Captain Artoloria, serving five years, and upon the basis of this army experience he wrote and published in 1644 at Augsburg, "Examen Chirurgicum."[1] He also tells us that he had continued his anatomical studies while with the army and had prepared and mounted skeletons "of which two still exist."

Of greater interest perhaps than these strictly personal details is the insight to be derived from studying his preface concerning his methods of thinking and writing and the beliefs and superstitions prevalent at this period. The dedication, addressed to eleven of his superior friends at Augsburg, breathes with the spirit of the fundamentalists, convinced of their eternal truth; he repeats the theological dogmas which guided thought disasterously through the doctrine of signatures and similar superstitions for so many years. The basis of much irrational medical thought may be found in the belief in the false syllogism: Since God has created man in his own image, he has concealed somewhere the material means for the alleviation of

[1] See, Index Catalogue of the Library of the Surgeon General's Office, U. S. A.

man's sufferings, therefore, the man who can find these secrets is the wisest man. Such an argument Schmidt advances in the entire context of his dedication.

The preface "to the Benevolent and Art-loving Reader" relates those details in his experience which qualify him to present the subject of anatomy. One gem

Fig. 1.

may be translated thus: "The knowledge and practice of this praise-worthy anatomical art is not only for the graduate physician, but for the right busy surgeon or wound doctor it is also useful and necessary in many ways."

In spite of his clear mind, he does not fail to conform to illustrious precedents, and introduces his preface with his conception of the comparison of the macrocosm and microcosm, which contains much that is old and very little that is original. The universe has three parts, heaven, air and earth,—so also has the body three parts, the head, the chest and the abdomen; as heaven is round, so is the head——and then he forgets his comparisons in his enthusiasm over the importance of anatomy.

Following the preface is a poem, probably written by the author himself, since it is not signed and similar ones may be found in other volumes of his works; it is fifty-six lines long and occupies two full pages. Translation of the words might be possible, but the spirit can be appreciated only in the original, so the last lines are reproduced:

Du trewer Artzt hör den bericht;
Wo du für Gott wilt recht bestahn/
Ein rein Gewissen für ihm han;
Wo du wilst deinem Rechsten gut
Recht dienen/wie Gott heissen thut/
So lass dir die Anatomy/
Ein Schlüssel seyn zur Artzeney:
Du solst sie wie ein Ruder han/
So wirst für jedem recht bestahn.

The collation of the book is as follows: "Spiegel der Anatomiae, Darinn zu sehen alle innerliche und ausserliche Gliedmassen des Menschlichen Leibs, Auff das kürtzest verfast. Durch Joseph Schmidt, Barbirer Leib und Wund Artzt. Johan Weh, Augsburg, 1646."12 mo. 12 ll. 457 pp. (wrongly num. 455). Engraved title, engraved portrait, 82 full page copperplates."[1]

The copperplates in it are signed "H. Radel, fecit." This artist has remained unnoted in Bartsch, Bryan, and other available biographical dictionaries. He may well have been the local goldsmith since at this period engraving was not an uncommon adjunct to the goldsmith's craft. Radel certainly was industrious and not devoid of ideas, although his technique may not have been of the best. In his title page design (Fig. 1) he could not resist the *momento mori* motif, but he surely added some novel details. The portrait is most attractive and represents personality much better than many of the contemporary portraits by greater artists. In this portrait, Schmidt is shown as a man of forty wearing

[1] Not in Haller, Gurlt, Defeyfer or Choulant.

with pride the short robe of the barber-surgeons. The tools of his craft lie on the table before him, and the escutcheons and emblems of his guild are added to the plate as decorations. (Fig. 2.)

The 82 copperplates, many having several figures, give a comprehensive view of the anatomical details of the entire body.

Fig. 2.

These figures are all copies, the originals of which may be found in Vesalius, Valverdus, Coitier, Pineaus, and Ceasserius. The modifications and combinations necessary to adjust these folio illustrations to the duodecimo pages are so ingenious that in most cases the essential details are not disturbed. Careful inspection shows that all of these plates are etched instead of being engraved. In previous anatomical illustrations, the line wood block and the engraved copperplate were used almost without exception. The technique of etching has been reserved to the greatest artists, probably on account of the difficulties of the process, so that the method adopted by Radel was not without its difficulties and his results must be estimated from this standpoint. Viewed in this light, it must be acknowledged that his illustrations are

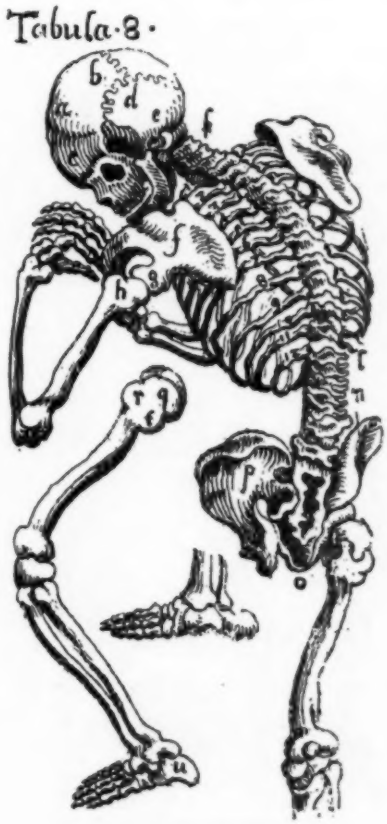

Fig. 3.

much more suitable than the first inspection indicates. (Fig. 3.)

The text itself is divided into two parts. There are 208 pages of purely descriptive anatomy; then, after the false title quoted above, there follow (pages 211 to 450) references by table and index number to the illustrations, which are all bound together at the end of the book. Nowhere is there any indication of the originals from which the illustrations were taken. The text concludes with a poem of five pages addressed to the "common barber": after epitomizing the anatomical names, the poem flows on to indicate that there were

the same problems of stealing patients, of ignorant associates, and other trade evils—not entirely done away with during the passing years.

Schmidt was rather a frequent contributor to medical literature. He is represented by at least four titles in the catalogue of the Surgeon-General's Library.

Fig. 4.

He seems to have continued his activities at Augsburg, for the dedication to his "Kürtzer . . . bericht, dreyer Erblicher Kranckheiten, . . . die pest, Frantzosen, und scharbockh, . . . " is dated at this city in 1667. This book was issued by the same publisher and illustrated by the same artist as the "Spiegel" of twenty years before. Ripe now in the experience of many added years of active practice, Schmidt qualifies as "barbierer, geschwornen Staff-brech-und wund-artzt." While addressing his work to barber-surgeons as before, now he does not hesitate to direct his advice to the young physician also.

In this volume, he treats of the pest, syphilis and scurvy. In the preface is the interesting statement that he personally had observed eight epidemics of the pest in Augsburg in his forty years' practice. In the text itself, he includes "a little chronicle" which postulates almost forty pest years in Augsburg between 1042 and 1667. The syphilis tract is full of interest; he accepts the idea of the Neapolitan origin; he divides the secondary phase into four types; he describes extragenital infection; he advocates mercurial treatment as well as the "wood," and the vegetable alteratives. Radel has contributed 20 etchings to this part of the book. Many plates show cuts of the highly ornamented surgical instruments of the period. A few depict operations, but the most attractive is a series of four plates representing treatment by fumigation in the consultation room of the barber. The details of the room, the bath cabinet, the position of the patient and the pose and costume of the barber make these etchings true genre pictures, which may rank with the lesser work of the famous Dutch contemporary, Jan Steen. (Fig. 4.)

In the last tract, there is a marked difference of thought and expression. Schmidt confesses that he has had very little personal experience with scurvy, having seen only a few cases and these during his army experience. He attempts to mask his own lack of knowledge by quotations from many authorities, with the inevitable result that this tract is much below his usual practical standard.

Should there be a moral to this tale? Schmidt's title, "The Mirror of Anatomy," is certainly suggestive. He looked into the mirror and was so well satisfied with his methods, knowledge and beliefs, that he gave them forth to the world in many volumes. Today, we use other methods, discount almost all his knowledge and characterize his beliefs as superstitions; but

should not our mirror tell us that we too perhaps place too much confidence in present day methods, knowledge and beliefs, which future students may also find absurd?

BOOK REVIEWS

We know of no occupation more fascinating than opening the covers of a new book and going on a mental pilgrimage of discovery through the pages. Once in a long time a thrilling surprise rewards the searcher. If one pursues the quest diligently he is sure to be pleasantly surprised at every turn. This was especially true this month. The books sent us for review made an impressive pile and we would have liked to have read every one of them. Alas! we are only a reviewer during our odd moments, and if we get through ten or a dozen works every full moon we are doing astonishingly well.

One evening not long ago we began our half hour reading prior to seeking our usual seven hours slumber, and selecting a book at random discovered it was The Discovery of Ether Anaesthesia by Frances Long Taylor, with a Foreword by Francis R. Packard. Eight excellent full-page plates are included in this tome of 237 pages, published by Paul B. Hoeber, Inc., New York. When we finished the last page we found we had read far into the night. Although we lost sleep we felt repaid by the fascinating account of a much debated subject by the authoress, the daughter of Dr. Crawford W. Long. Mrs. Taylor, we have been told, is a lady now past four score of years, living at Athens, Georgia. Only the other day we saw a letter she had occasion to write concerning some business and the penmanship was that of a girl in her early twenties.

In the Author's Note one reads, "This book has been written with the aim of presenting an absolutely truthful account of the life and work of Dr. Crawford Long . . . Upon investigation the author finds that on the first meeting (Georgia Medical Association, known as the Georgia State Medical Society) no formal business was transacted except the passing of a resolution that the Legislature be requested to pass a certain bill. The writer also finds that Dr. Long jointed this Society at a meeting in Savannah, April 1853, and at that occasion read a paper on his discovery of sulphuric ether as an anaesthetic."

Dr. Francis R. Packard in the Foreword says, in part, ". . . Although the facts bearing on the discovery of ether may be summed up in a few paragraphs and have long been clearly established, nevertheless from time to time echoes of the furious battle which it aroused are heard. There are two outstanding facts which emerge from the mass of statements, claims and contradictions bearing on the subject, i.e., Crawford W. Long was the first man to use ether for the purpose of producing surgical narcosis, and W. T. G. Morton was the first to demonstrate its use before a professional gathering . . . Long and Morton were the direct anthitheses of one another. Long's use of ether as an anaesthetic occurred in an accidental manner. Morton's discovery of ether was the result of a deliberate search for an agent to relieve pain during a surgical procedure. Long practiced in a small rural community where he had no opportunity to talk with professional colleagues, no hospital in which he could observe its effects on a number of cases . . . Morton made his discovery in one of the medical centers of the United States . . . Nevertheless between 1842 and October 16, 1846, when Morton etherized a patient at the Massachusetts General Hospital, Long had undoubtedly used ether many times as an anaesthetic.

"This little book which follows is the result of a lifetime of filial devotion. As a young woman Mrs. Taylor was intimately acquainted with all the details of her father's work. He was too modest and retiring a man to push his claims as vigorously as the other candidates for the honor of the discovery. While Morton and Jackson were clamoring for pecuniary rewards and personal fame, Long pursued his daily avocations and only ventured to issue a statement of what he had done without making any claim for recompense. Since his death his daughter has labored unceasingly to place his just claims in their true light . . . In the following narrative the reader will find a beautiful picture of a doctor of the old school whose life was passed in doing good deeds. . . ."

In the Introduction we learn "this little sketch" was not originally written for publication, but for Dr. Long's grandchildren. After the Introduction we are taken to a chapter devoted to Long's parentage, birth and education. The third chapter is devoted to his medical education and early practice, and

the following chapters to the first use of ether as an anaesthetic, publication of the results of the use of ether, the famous ether controversy, the Civil War, last years and death, and recognition.

A delightful book. A book every physician interested in the history and the culture of his profession will want to possess, keep on his shelves, and of an evening, when the day's *work* is finished take down, open and read for the sheer enjoyment resulting from the witchery of words.

Another worth while book is GYNECOLOGY FOR NURSES by Harry Sturgeon Crossen, M.D., F.A.C.S., Professor of Clinical Gynecology, Washington University Medical School, etc., with 365 engravings, including one color plate. It is published by the C. V. Mosby Company, St. Louis, 1927.

One can criticize the perfect if he tries hard enough, and we could pick flaws with parts of this book of 281 pages, but on the whole we would stamp Dr. Crossen's "Gynecology for Nurses" as an ideal work of its type. Not only will a study of its pages make for a better nurse but physicians might read it with profit. We object to photomicrographs and the technical steps of surgical procedures for nurses' reading, but these are far outbalanced by page after page of solid, necessary information. We would have every student and graduate nurse own a copy. If such a nurse were lazy and did not read the text carefully, a mere study of the many well-done illustrations would give her more useful knowledge of a practical nature than would hours of dry, canned lectures. The cost is $2.75. The part devoted to Preparation of Supplies, alone, is worth the cost of purchase.

Bound in the usual paper cover we picked up CANCER D' ESTOMAC by Victor Panchet and A. Hirchberg. There are 173 illustrations and it is published by Gaston Doin & Cie, Paris, 1928 The price is 45 francs.

When one contemplates this work, after reading it, he wishes the entire medical profession could read French. For the authors have done a thorough bit of work in an interesting manner. The illustrations are well executed and, in part, show the steps in the various operations. Besides a consideration of the technique of operations for the relief of cancer of the stomach, chapters are devoted to considerations of diagnosis, pathology, complications, etc., all illustrated showing gross specimens and microscopic sections. If one is a surgeon and can make a little head and tail of scientific French, he should by all means own this book.

J. B. Lippincott Company (1927) have brought out another of their INTERNATIONAL CLINICS, a Quarterly of Illustrated Clinical Lectures and Especially Prepared Original Articles . . . by leading Members of the Profession Throughout the World. This book is of Volume III . . . Thirty-seventh Series.

Naturally the medical profession needs no introduction to these valuable contributions to medical literature. Volume III (311 pages) is composed of ten articles devoted to diagnosis and treatment, one article each on medicine, surgery, obstetrics, neurology, medical history, and two articles on post-graduate study. There are three colored plates and numerous illustrations and figures.

A work that should be welcome is POLIOMYELITIS with Especial Reference to the Treatment, By W. Russell MacAusland, M.D., Surgeon-in-Chief, Orthopedic Department, Carney Hospital, Boston, Mass. It is illustrated with 173 engravings and is published by Lea & Febiger, Philadelphia, 1927. The price is $5.50 net.

In the preface we read " . . . The greatest progress has been made in the methods of treatment, and particularly in the orthopedic field. Deformity can now be prevented in nearly every instance; the return of function can be hastened by proper treatment of the involved area; and, finally, by the use of surgical procedures, the wearing of cumbersome apparatus may be obviated in the majority of cases.

"From the voluminous material that has been published on poliomyelitis, the writer has tried to select the factors that are recognized as having definite value. In the epidemic and experimental field, in which much remains to be determined, the most recent investigations have been reported. From the large number of operative procedures that have been devised for paralytic conditions, the writer has selected those measures that have stood the test of time and can be accepted as standard."

MacAusland in his work lives up to his preface. In many cases the aftermath of this dread disease is horrible, and for a long time the treatment of complications following in the wake of the acute condition was in a chaotic state.

MacAusland has done an admirable piece of work. Internists, surgeons and orthopedists are hereby advised to buy this book.

A typically French surgical work, one of a series, is recommended to all general surgeons. It is La Pratique Chirurgicale Illustreé by Victor Pauchet (Fascicule VI). It is 274 pages and has 275 illustrations by S. Pupret. The publishers are Gaston Doin & Cie, Paris, 1927. The price is 55 francs.

If one reads French he has a delightful time ahead of him and is sure to profit from a consideration of the text. If one does not read French he may profit by observing the wonderful illustrations, which are easily understood. The following topics comprise the volume:

Traitement du Xanthelasma.

Ulcus pénétrants de l'estomac et du duodenum.

Exploration de la region pyloro-duodénale.

Anus coecal dans l'obstruction intestinale par cancer colique.

Traitement du cancer du colon (angle hepatique).

Hernie crurale gangrénée.

Les diverticules de la vessie.

La Splenectomie.

While we are on the subject of foreign medical books we wish to draw the reader's attention to two German works. The first is Die Blut-transfusion by Dr. E. Kubányi, with a foreword by Professor Dr. L. V. Bakay. It is published by Urban & Schwarzenberg, Berlin, 1928. The price is 6 marks.

The author has covered the broad field of transfusion in a comprehensive and thorough fashion. Nothing has been left unsaid. But much of the text seems unnecessary in view of the fact the procedure has become a commonplace. One may almost assert that a homo medico cannot aspire to immortality in the surgical realm unless he has devised and has called after his name a blood-transfusion apparatus.

To the student and anyone interested in everything ever written on the subject this work will appeal, for the bibliography is complete as is shown by the fact it covers 24 pages of finely printed text.

The other German work is Der Freibende Uterus—in operations—anatomischer Darstelling . . . by Wilhelm Liepmann. The Berlin firm of Urban & Schuarzenberg, 1927, are the publishers. The price is 18 marks.

This excellent atlas, if one may so term it, is of great interest to the obstetrician. It is in length but 43 pages, but the pages are very large. Following a foreword and an anatomy of postmortem findings of the post-partum uterus, with 6 illustrations, there are 8 tabules, consisting of enlarged illustrations on one page and on the opposite page the legend in detail. The art work is in black and white. To anyone interested in obstetrics this brief work is recommended.

We are nearing the end of our alloted space and will use it to recommend a few very worth while books. The general practitioner and internist will be intrigued by T. Stacy Wilson's Tonic Hardening of the Colon. It is published by Oxford University Press. A sane, interesting discussion of the colon and its diseases and the symptoms resulting thereby written from a new angle, the whole chock full of meaty facts.

Cancer Control . . . Lake Mohonk Conference, 1926. Report of An International Symposium Held under the Auspices of the American Society for the Control of Cancer, published by The Surgical Publishing Company of Chicago. If particularly interested in the many phases of this subject you will want this book.

Hygiene und Diatetik der Frau by Dr. med. Hugo Sellheim, with 193 illustrations, published in München by Verlag von J. F. Bergmann. Splendid book. It is worth while for someone to translate it into English. A book every general practitioner could read with profit . . . that is, if he reads German. Otherwise, it would be a dead loss, except that the pictures are interesting.

Die Chirurgie der Lungenerkrankungen by Prof. Dr. W. Jehn with 68 illustrations and 15 color plates.

Die Chirurgie des Brustkorbes by Prof. Dr. A. Schubert, with 35 illustrations and 11 color plates.

This is one of a series of surgical monographs. To the student of German they will prove valuable. Any surgeon who is interested and who does thoracic surgery should get this book (price 19 marks) for the illustrations and colored plates, if for no other reason. The authors have been most thorough and conservative and the net result is a work of remarkable merit.

We still have a high pile of books . . . many of them you will want to own . . . and we would like to say a few words about every one of them . . . but enough for this time. Next month we will begin where we now leave off.

BOOKS RECEIVED

UROLOGY. By William F. Braasch, M.D., F.A.C.S., Head of Sect. on Urology, Mayo Clinic; Prof. of Urology, Mayo Foundation for Med. Education & Research, Graduate School, Univ. of Minnesota. In collaboration with Benjamin H. Hager, B.S., M.D., Assoc., Sect. on Urology, Mayo Clinic. Ed. 2. 8vo. Cloth. Pp. 480, 759 roentgenograms. Phila. W. B. Saunders Co., 1927.

THE EFFECT OF HEAT UPON RAT-TUMORS. By Nils Westermark. Sonderabdruck aus *Skandinav. Arch. f. Physiol.*, vol. lii. Berlin. Walter de Gruyter & Co., 1927.

THE CURRENT SIGNIFICANCE OF THE WORD ALUM. By William D. Richardson, Former Ed., *Industrial Engineering Chem.;* etc. 8vo. Cloth. Pp. 93. Chicago: Commonwealth Press, 1927.

ATLAS DER HISTOTOPOGRAPHIE, GESUNDER UND ERKRANKER ORGANE. By Erwin Christeller, Direktor der Pathologish Anatomischen Abteilung des Stadtischen Rudolf Virchow Krankenhauses in Berlin. Folio, Cloth. 182 photo on 88 pl., 4 text illus. Leipzig: Georg Thieme, 1927.

DIE LAGERUNG VERLETZTER UND ERKRANKTER GLIEDMASSEN LEERSCHIENEN UND VERBANDLOSE WUNDBEHANDLUNG. By Geh. Med. Rat. Prof. Dr. Heinrich Braun, Zwickau. 8vo. Paper. Pp. 118, 101 Illus. Leipzig: Barth, 1928.

EPIDEMIC ENCEPHALITIS (ENCEPHALO-MYELITIS). By Leo M. Crafts, M.D., Formerly Dean and Prof. of Nervous and Mental Dis., Med. Dept., Hamlin Univ. 8vo. Cloth. Pp. 237, Illus. Bost. Richard G. Badger, 1928.

TREATMENT OF OSTEOLYELITIS AND OTHER INFECTED WOUNDS. By H. Winnett Orr. Cloth. Pp. 54. Repr. from Surgeon General's Office.

PERCIVAL'S MEDICAL ETHICS. Ed. by Chauncey D. Leake. 8vo. Cloth. Pp. 289. Balt. Williams & Wilkins Co., 1928.

DIAGNOSIS AND TREATMENT IN DISEASES OF THE LUNGS. By Frank E. Tylecote, M.D., D.P.H., F.R.C.P., Hon. Phys., Manchester Royal Inf.; Lect. in Clin. Med., Victoria Univ. of Manchester; and George Fletcher, M.A., M.D., M.R.C.P., D.P.H., Ass't. Tuberculosis Officer, Lancashire County Council. 8vo. Cloth. Pp. 270. London. Humphrey Milford, Oxford University Press, 1927.

CLINICAL RESEARCHES IN ACUTE ABDOMINAL DISEASES. By Zachary Cope, M.D., M.S., F.R.C.S., Senior Surg. to Out-Patients, St. Mary's Hosp., Paddington; Senior Surg., Bollingbroke Hosp., Wandsworth Common; Hunterian Prof. & Sometimes Arris & Gale Lecturer, R.C.S. Ed. 2. 8vo. Cloth. Pp. 214. Humphrey Milford, Oxford University Press, 1927.

THE PNEUMOTHORAX AND SURGICAL TREATMENT OF PULMONARY TUBERCULOSIS. By Clive Rivers, M.D., F.R.C.P., Phys., City of London Hosp. for Diseases of Heart and Lungs; Phys., East London Hosp. for Children. 8vo. Cloth. Pp. 311. Humphrey Milford, Oxford University Press, 1927.

BACTERIOLOGY AND SURGERY OF CHRONIC ARTHRITIS AND RHEUMATISM WITH END RESULTS OF TREATMENT. By H. Warren Crowe, M.D., B. CH. M.R.C.S., L.R.C.P. Chapter on Surgical Treatment by Herbert Frankling, C.B.E., M.R.C.S. 4vo. Cloth. Pp. 187. Humphrey Milford, Oxford University Press, 1927.

PATHOLOGICAL PHYSIOLOGY OF INTERNAL DISEASES. By Albion Walter Hewlett. 8vo. Cloth. Pp. 787, 164 Illus. N. Y. D. Appleton & Co., 1928.

GYNECOLOGY. By Howard A. Kelly, A.B., M.D., LL.D. 8vo. Cloth. Pp. 1042. N. Y. D. Appleton & Co., 1928.

KURZE GESCHICHTE DER CHIRURGIE. By W. von Brunn, Prof. f. Geschichte der Medizin a. d. Univ. Rostock. 8vo. Paper. Pp. 339, 317 Illus. Berl. Julius Springer, 1928.